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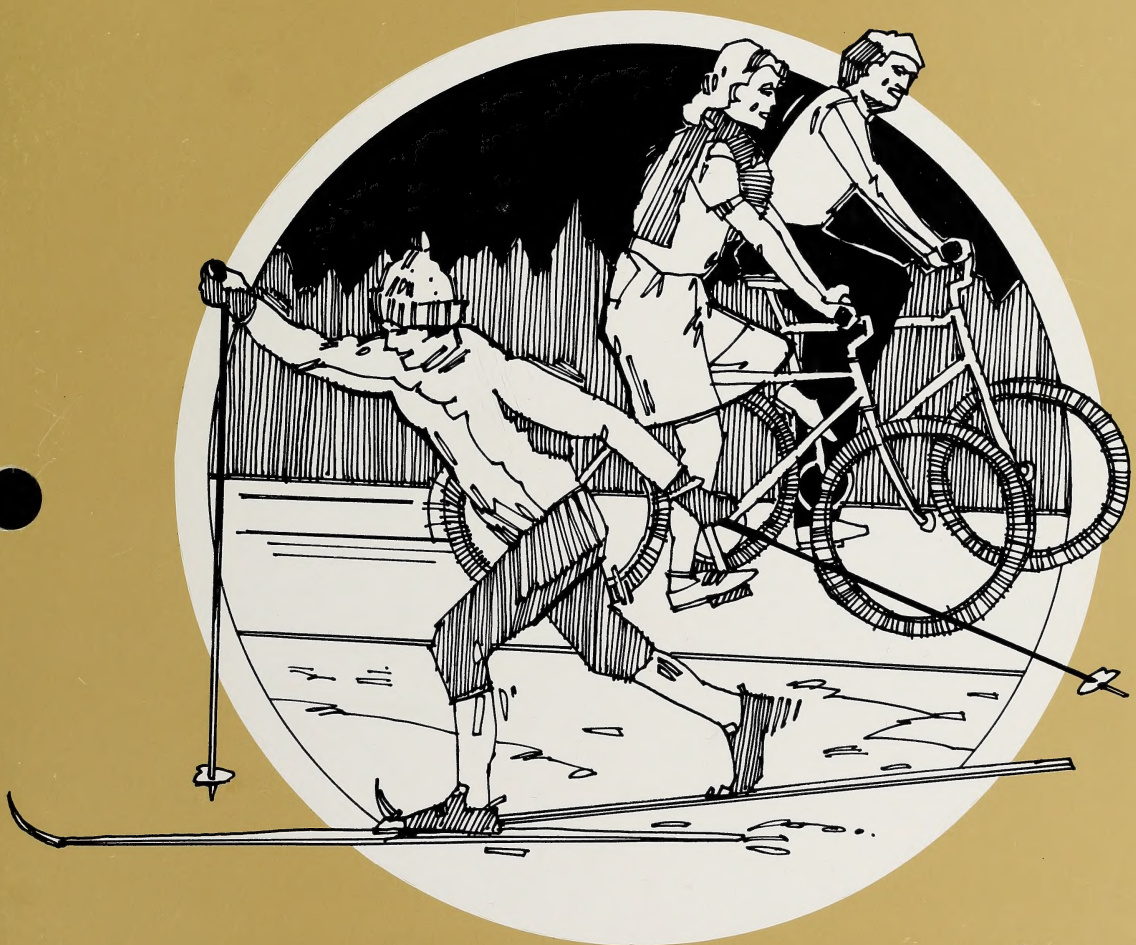
Recreation Trails



Alberta

RECREATION AND PARKS
Recreation Development Division

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INTRODUCTION

Your Trail Starts Here

If you've decided to build a recreation trail in your community - congratulations! Of all outdoor recreation facilities, a trail can be one of the most rewarding and one of the most versatile. Unlike other facilities which appeal only to specific interest groups or fitness buffs, everyone can enjoy a trail - senior citizens, young families, people with handicaps and groups and clubs. Your trail will offer an exciting outdoor experience to all. It will also add a valuable asset to your community.

You probably have a clear picture of what your trail will be when it's complete. Reading through this manual is a positive first step toward putting that picture into focus.

What You'll Find In This Manual ... What You Won't

First, this manual deals only with "non-motorized" trails. It covers hiking, bicycling, cross-country skiing and horseback riding trails. It doesn't give information on trails for snowmobiles, motorbikes or other motorized vehicle use.

Second, it is a general overview of trail development guidelines - not a detailed "how to build it yourself" instruction manual. For example, instead of finding blueprints on the construction of a trail bridge, you'll learn why, where and when trail bridges are necessary. While you will no doubt want to obtain more information on construction techniques later on, this manual will provide you with a useful starting point. It outlines the basics of trail planning, design, construction and maintenance and introduces specific considerations for the basic trail types.

It will prove especially valuable to you and your group if this is your first trail project. By reviewing it carefully, you'll have a good understanding of what will be involved in trail development, what steps to take to ensure success and how to avoid potential problem areas.

Wondering where you can find more information? We've even taken care of that! For your convenience, we've included references and resource materials at the conclusion of this manual.

Successful Trails Start With Understanding

Even if you have a good idea about what kind of trail you plan to

build, where it will run and who will enjoy it, you may be uncertain how to begin. Trail development starts with two basic factors - the first is people; the second, nature. Both are important!

1. Concern for People

On one hand, your trail should meet the needs of all the people who will use it in years to come. For example, you'll want to ensure grades aren't too steep for the comfort of hikers, cyclists or riders or too narrow for groups. You wouldn't want a hiking trail to lead people into a marsh or a winter trail to lead cross-country skiers under low-hanging branches or across a busy roadway. On the other hand, and just as important, are aesthetic concerns. These relate to the trail's appearance. Every trail should be attractive on a number of levels. People will be drawn to your trail if it provides scenic vistas, offers activity or interest areas along its route and provides a variety of experiences. In fact, there are several elements to consider in developing a trail with good aesthetic values:

Interpretive opportunities: Where possible, the trail should feature natural, geographic and historical highlights.

Scenic interest: The trail should provide views from a variety of levels. Elevated trails can provide breath-taking views of the landscape. Enclosed spaces within woods will focus attention on landscape features in the foreground.

Design detail: Materials and finishes along a trail should be selected to enhance the trail's theme. A variety of materials may be used to add diversity.

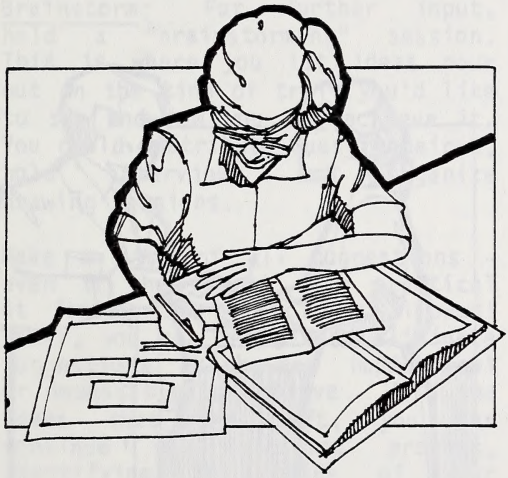
Secondary recreation activities: Where possible, trails may offer users related recreation activities, such as swimming and boating.

2. Concern for Nature

You'll want to preserve the environment in the trail area. The impact of civilization on wildlife and its habitat, wild flowers and plants in the area cannot be avoided but must kept to a minimum. In all but a few urban trails, the natural environment is a vital part of the trail experience. Damaging the environment will simply detract from the value of the trail.

To protect the trail's environment, you'll need to plan carefully to avoid disturbing the delicate balance of nature. Perhaps the most important factor is "carrying capacity", the amount of use an area can withstand without being damaged.

PHASE I: PLANNING FOR SUCCESS



Why Planning Is Important

Now we get down to work - planning. The planning stage is the most important, because if you have a clear picture of your trail now, you can save yourself a great deal of time and trouble later. Finding that there is a similar trail close to the one you are building can be very expensive and wasteful. You may find that a handicapped group would like to use your new trail and you haven't provided for them or that you could have used an abandoned logging road for your trail and didn't.

Starting Out: Developing a Master Plan

Trail planning should be a broad-based process, rather than a piecemeal approach, carried out within the scope of an overall plan - a "Master Plan".

In developing a Master Plan, many factors are taken into account - people, environmental concerns, finances and future demands for trails. With a Master Plan, you will be able to co-ordinate the design and construction of the trail more efficiently. It will also enable you to prepare a realistic schedule for completing the trail, based on the requirements and resources of your group. If you anticipate financial problems, it should allow for the gradual development of the project in phases. Phase I could include Planning and Design; phase II, the construction of one leg of the trail; phase III, an extension of the first leg; and so on.

Although the size and scale of your project might be intimidating at first, creating a Master Plan allows you to proceed in easy, manageable stages. The stages in the planning process are:

1. Defining the Project
2. Researching Your Requirements
3. Gathering a Team
4. Identifying Resources and Analyzing this Information
5. Preparing a Concept Plan

1. Defining the Project

Part of master planning is deciding why you and your group want or need a trail. Ask yourselves:

- Why is the trail being built?
- Who is it serving?
- What are the natural, cultural and historical features we should be including?

Write down the reasons for building the trail in a simple, clear language. You'll need a statement of objectives, something to which everyone in your group can agree. For example, it could say:

> TO PROVIDE AN EXTENSIVE NETWORK OF STROLLING, DAY USE HIKING AND LONG-DISTANCE BACKCOUNTRY AND WILDERNESS HIKING OPPORTUNITIES. TO ALSO PROVIDE A NETWORK OF SELF-GUIDING INTERPRETIVE TRAILS THAT USE A VARIETY OF APPROACHES, SUCH AS SIGNS, LEAFLETS OR OTHER METHODS, TO CONVEY A STORY OR CONCEPT TO THE VISITOR. TRAIL OPPORTUNITIES WILL BE GIVEN TO THE WIDEST VARIETY OF USERS, INCLUDING THE HANDICAPPED. IN WINTER, SEVERAL CORE AREAS WILL BE PROVIDED FOR DAY USE CROSS-COUNTRY SKI TRAILS, AS WELL AS FOR SNOWSHOE TRAILS WHICH WILL NOT CONFLICT WITH SKI TRAILS.

Trail User/Demand Survey: Next, find out who the trail will be serving by taking a Trail User/Demand Survey. You'll learn whether users are primarily walkers, climbers, hikers, naturalists, schools, family groups or cross-country skiers. You'll also discover if your trail is meeting the present and future needs of the people who will be using it. What do they want in a trail? Will users be local or will the trail draw people from far away? Will people with handicaps be using it? Are there any potential conflicts in the use of the trail?

To determine exactly who will be using the trail, holding a public forum in addition to a survey may be useful. Call attention to it by inviting the public to attend through a press release, letters or flyers delivered to homes in your area.

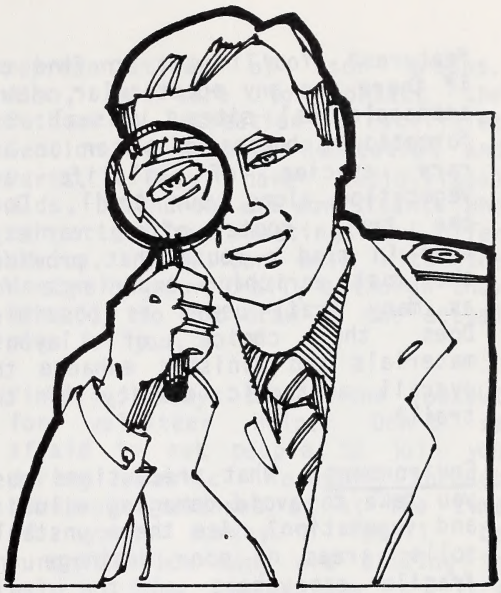
Brainstorm: For further input, hold a "brainstorming" session. This is where you let ideas pour out on the kind of trail you'd like to see and how you can achieve it. You could distribute questionnaires, hold interviews and organize drawing sessions.

Make a list of all suggestions - even if they don't seem practical at first. No criticizing allowed! Later, you can refine and eliminate suggestions which are impractical or impossible to achieve. With the ideas that are left, you can continue the planning process, identifying the needs of your "client groups" (users), the resources available to you and what the site can support.

2. Researching Your Requirements

Once the reasons for the trail are established - the who and why - the next step is to find out what your trail will require. This means research.

Like a good detective, you'll have to be persistent, asking many questions and checking all the sources available to you. For a list of information sources, check the back of this manual.



In your research, you'll be looking for information on the following aspects of the trail:

Functional: How to design the trail for the comfort and safety of trail users? You'll also need to know what the area is like in which you plan to build: its topography, drainage and vegetation. For example, a trail with many steep hills or mountain slopes will concern cyclists more than hikers. Also, find out if there are any dangerous areas on the trail route, such as cliff edges or streams with rapids. And, learn what the climate of the area is like - the prevailing winds, shade conditions, slope orientations, rainfall and avalanche conditions in winter and early spring.

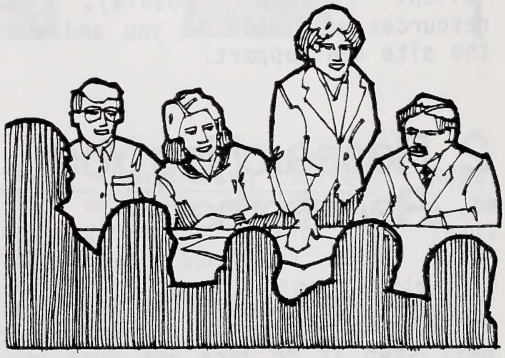
Aesthetics: What aesthetic concerns do trail users have for the type of trail you plan to build? They will be different for the dedicated wilderness hiker than for casual day hikers. Will the route take full advantage of any exceptional natural or historical

features? You'll want to find out if there are any spectacular views, archaeological sites, unusual rock formations, bodies of water or any rare species of wildlife and vegetation along your trail. Does the trail route offer variety? Keep in mind a route that provides the most enriching experience for as many trail users as possible. Does the choice of layout, materials and finishes enhance the overall aesthetic quality of the trail?

Environment: What precautions must you take to avoid damaging wildlife and vegetation? Are there unstable soils, areas of poor drainage and fragile ecosystems on the trail site? Make sure you know where all sensitive areas are located on the trail route. Identify those areas with the help of a naturalist. Then, plan to avoid them or, if that is not possible, take measures to reduce the degree of impact that trail use will have on the environment.

Legal: Do you know the legal status of the land you plan to acquire and whether there are any restrictions on it? Get the most accurate, up-to-date information on the ownership of the land you're looking at. Find out the regulations in your area concerning public land use and land-use policies relating to the development of trails. You'll need to know the persons or agencies to contact for the necessary approvals. Finally, make sure you know who will be liable if there is an injury on your trail. You may want to incorportate your trail development group to protect your members. To help you with the often difficult and complex issues governing land use and liabilities, track down a lawyer who is willing to join you. This person will be one of your group's most valuable assets.

Financial: Does your group have all the financial resources necessary to build a trail? The type of trail, the use of volunteer or hired labour and the equipment materials will all have a bearing on the costs of construction. You may have to consider less expensive alternatives or search out sources for additional funding. Assistance is often available from the government, depending on the need your trail fills and where it is to be located. Before building anything or hiring anyone, you'll need to work out a cost estimate. (At the back of this manual, you will find a sample budget you can use as a starting point.)



3. Gathering a Team

The people who make up your group may work well as individuals, but they will be even more effective if organized properly. At this stage, decide who will:

- act as liaison between the local recreation board and your group
- investigate sites
- recruit new members for your group
- raise money and apply for grants
- obtain information on the design, construction and maintenance of trails

Then, form a planning committee, choose a leader and give people responsibilities. Who will contact the local recreation board to make sure your project isn't duplicating another one already underway? Who should be in charge of getting more information on alternatives for design and funding?

With A Little Help From Your Friends

Depending on who is in your group, you'll probably need more help to see your Master Plan through. This means acquiring specialists in those areas where you might not have expertise.

Decide who is actually going to design the trail. Again, this will depend on finances. If one of the members of your group has formal design training and experience, you could save money by doing it yourselves. If not, hire the professional services of a trail designer or landscape architect and be sure to inform the designer early on about the objectives of the trail.

You should also try to include a visitor services officer (for advice on trail use requirements), a warden (managing natural resources) and a works officer (construction and maintenance).

Others who can help are ecologists, engineers, architects, geologists, soil scientists, archaeologists and representatives of user groups. Also, be sure to contact the Outdoor Recreation Facilities Section of Alberta Recreation and Parks. They have audio-visual aids, brochures and consultants who can attend your meetings and offer advice. They can help with the design of your trail, although they normally do not draw up the actual plan for you.

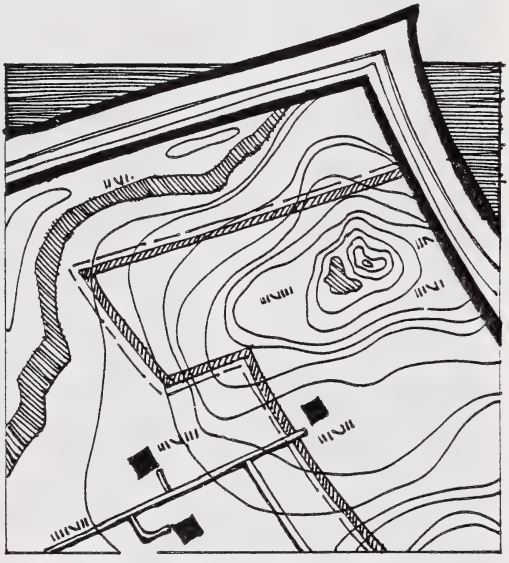
Finally, always be on the lookout for volunteer help. Don't be afraid to ask people to join you during public forums, through newspaper releases or at the time of your survey. You'll be surprised how many are willing to help. Show enthusiasm - it's catching!

Once your team is gathered together, there's one last, but very important, organizational detail - your group's legal incorporation. By incorporating you will ensure that no individual member of your group is legally liable. As added bonuses, incorporation will encourage you to organize your business more efficiently and give your group more credibility when you negotiate with agencies for funding and approvals. If you have a lawyer, have him or her advise you on the best way to incorporate.

4. Identifying Resources

The next step in the planning process is to identify all the resources the trail site offers. These would include: topography (slope and elevations); geology (rock outcrops, bedrock, escarpments, etc.); soils (soil types,

drainage, signs of erosion); hydrology (lakes, rivers, streams, marshes, springs); vegetation (types of forests, plant communities, rare plant species); wildlife (mammals, fish, birds - especially endangered species); climate (prevailing winds, shade conditions, precipitation, avalanches); and man-made conditions (townsites, bridges, roads, railways, historical sites, resource developments, etc.). Knowing this information will help determine how the trail should be routed.



Maps/Aerial Photography: Start with good contour or topographical maps and aerial photographs. Although maps and aerial photographs cannot substitute for an actual trip into the field, they will enable you to locate such geographical points of interest as cliffs, caves and rock outcrops, as well as anticipate problem areas and choose alternate trail routes.

With large-scale maps (1:5000) you'll be able to avoid major obstacles and find river and stream crossings. These maps will also help you avoid high peaks and steep slopes, find long ridges for easy trail routing and locate towns, roads and highways. Smaller scale maps (1:50) can help you find control points, which are those features of the terrain you want the trail to connect. They also allow you to rough out downgrades or upgrades and find access points from main roads and highways.

The best aerial photos are ones with stereo coverage. Viewing these photos is almost as good as walking the route itself. Providing vivid three-dimensional views of the terrain, they can assist you in determining how suitable a particular hillside is for an upgrade or downgrade, finding major obstacles, spotting interesting site features and locating old roads or railway lines not shown on maps.

Where to Find Them:

Maps Alberta
Bureau of Surveying and Mapping
Alberta Energy and Natural Resources

2nd Floor, North Tower
Petroleum Plaza
9945 - 108th Street
EDMONTON, Alberta
T5K 2G6
Phone: 427-7417

Room 804, J. J. Bowlen Building
620 - 7th Avenue, S.W.
CALGARY, Alberta
T2P 0Y8
Phone: 297-7389

Sun Centre, 3rd Floor
530 - 8th Street, S.
LETHBRIDGE, Alberta
T1J 2J8
Phone: 329-5424

Subagent of Public Lands
Alberta Energy and Natural Resources

Room 3001, Provincial Building
10320 - 99th Street
GRANDE PRAIRIE, Alberta
T8V 6J4
Phone: 538-5260

Box 1959
ST. PAUL, Alberta
T0A 3A0
Phone: 645-6336

Bag 900, Box 35
Provincial Building
PEACE RIVER, Alberta
T0H 2X0
Phone: 624-6116

District Supervisor
Alberta Energy and Natural Resources

Box 1660
BARRHEAD, Alberta
T0G 0E0
Phone: 674-3351

Room 116, Chinook Place
623 - 4th Street
MEDICINE HAT, Alberta
T1A 0L1
Phone: 529-3677

Route Inspection: This is the fun part. It's time for you (and your designer) to put on your hiking boots and outdoor gear. You should bring along such equipment as a camera, compass, note pads and binoculars - don't forget the mosquito repellent!

For measuring grades, get a small hand-held "Abney Level" (the kind marked in percents). You'll want to bring plenty of plastic flagging (in different colours for coding) so you can mark trails and all outstanding natural features, good and bad. Flag more than you think is necessary. (Six months from now, much of the tape will be gone.)

Walking the trail route is the only way you can actually tell if it is suitable and if you need to find alternatives. Ideal times for doing this are early spring or late fall when most trees are bare and it's possible to see a broader range of territory.

Disadvantages: Once you set out, walk the trail route along its entire length. Then walk it again, going in the opposite direction, to find out whether it is more difficult or strenuous that way. As you go, check for the obstacles you identified on the contour maps and aerial photos to see if they are actually as serious as you thought. Also check if soils or drainage will be a problem. See if there are any natural processes (e.g., flooding or avalanche hazards) that make the trail unusable in some seasons. And, make sure you identify where there might be problems, such as use conflicts (e.g., a highway near a bicycle trail), privately held lands and easements and difficult access points along the trail.

Advantages: Look for any advantages the route offers. You'll be watching for interesting species of animal and plant life, waterfalls, panoramic views and historical features that give interpretive opportunities. Be sure to locate the best areas for campsites, lookouts and rest spots. How will the climate affect the trail? Are some areas likely to have more snow than others for cross-country skiing? Is there a balance of sun and shade in summer and protection from the wind in winter? Finally, look for materials available at the site or close by that you can use for complementary trail furnishings. Bridges, stairways and other structures will be far more attractive if they are built from local materials.

Before deciding on a route, pick at least TWO - one that best fits your needs and an alternate that costs less. Then, write up an inventory of site conditions: hydrological, topographical and geological features, soils, drainage, vegetation, climate, wildlife and man-made features. List the structures required and where you want them: bridges, rest stops, picnic tables, camp sites, stairways and directional and interpretive signage. Wherever possible, avoid building structures. For example, direct the trail around a marshy area instead of building a boardwalk over it.

As you take inventory, think ahead. What will the trail be like to maintain after it is built? For example, a kilometre of tangle bush you clear today will be a kilometre of tangle bush you'll just have to clear again in two years.

5. Preparing a Concept Plan

Now that you've come this far, you'll be loaded down with information. How does it all fit into the original objectives of the trail? At this stage, you may want to re-evaluate some of your first ideas to keep the trail within budget or to include features you hadn't thought of.

All the research you've done will enable you to make sound decisions

on where your trail should and shouldn't go. You'll know which areas to avoid (wildlife habitats, steep slopes, terrain with unstable soils, sensitive ecosystems) and which areas to include (viewpoints, waterfalls, historical sites).

Drawing Conclusions: The next step is to draw up with the designer a working design or a concept plan that includes route options. More than one concept plan may be developed. It will indicate approximately where the trail should be routed, noting the area's best features and indicating points of interpretive or visual interest and any structures that will be required. It is not a final design and probably will be altered several times before you make a decision. As a concept plan only, it will help the designer and your group evaluate and select the final route.

Acquiring the Land

Before proceeding to the final design stage, you will need to secure access to the land the trail will cross. Because your design is still in the concept stage, be prepared to make further changes if you cannot acquire all the land. Have alternate routes in mind. While scouting the land, be aware of the laws on trespassing. In Alberta, you need permission to enter private lands, whether or not a sign has been posted.

Wherever you can, make use of public land for your trail. Otherwise, if your route must cross private land, you'll have to negotiate written permission to enter or an easement.

Private Lands

In negotiating with landowners, explain your intentions thoroughly, making sure all parties understand why you want access to their land. Explain where you want the trail to run (from X's land through yours to Y's land) and reassure them that you will take every precaution to protect property and any livestock. If at all possible, get their permission in writing. This can be for as brief a period as one year, but try to get a longer agreement.

Don't let a refusal put you off. Landowners may well change their minds later, especially if neighbours who have agreed are experiencing no problems with trail users. When landowners do give you permission, be sure to keep them informed about the progress of your trail by including them on your mailing list.

Public Lands

In obtaining access to public land, there are several steps you'll have to take. First, you'll need to

check with the Department of Energy and Natural Resources, Dispositions Section. On vacant public land, you'll find that no authority is required for short-term, non-intensive use. For trail development on public lands, you need a "Licence of Occupation" to receive a disposition for trail development. If there is an existing disposition, the proposed trail development will be reviewed for compatibility with existing dispositions. In areas where there will be a trail-related development, such as a campground, then you can apply for a "Recreational Lease".

At the same time, check to see if the land you want is:

- in a forested region (the green zone), which can have various authorized uses such as logging; and
- part of a trapline, as trapping will conflict with the uses of your trail (trappers are allowed snowmobile access).

Also check for non-agricultural land dispositions, such as rural electrification easements for power lines and licences of occupation for access roads and airstrips. Other restrictions to look for are pipeline leases, recreation leases and leases or licences for recovery of minerals, oil and gas and the extraction of gravel. All existing dispositions will have precedence over any subsequent disposition for trail development.

Finally, you must check for rights-of-way. For roads, contact Alberta Transportation and the local municipality. Contact your utility company for utility lines and the rail companies for rail lines. Abandoned rights-of-way may be suitable trail corridors. If there is a bridge crossing, you may need to get in touch with Energy and Natural Resources, Alberta Environment and/or the federal government, depending on the type of bridge you wish to use or build.

Confusing? It may well be - but clearing up these issues now will save you a lot of time, money and trouble later. The lawyer on your team (if you have one) will be able to help. A publication that you will also find useful is: "Alberta Public Lands", available from Alberta Energy and Natural Resources.

PHASE II: DESIGN

Focus on Site Features

Trail design is probably the most important factor in determining

whether or not your trail includes the best available scenic, historical, ecological and geological opportunities. Let's review the advantages and disadvantages your route may offer.

Advantages

Ridge tops provide panoramic views of the surrounding countryside and enable you to select a route that minimizes the number of grades.

Escarpments are steep-sided valley rims that present few grading problems. Examples are high cliffs, deep ravines and rock outcrops that give beautiful views of the terrain below.

Stream bottoms can be excellent for observing unusual forms of plant life, although you should watch for potential flood and drainage problems.

Farm fields and meadows provide variety and relief if most of the trail is wooded. Where you can't cross a farm, providing a view of a field can be just as satisfying as having access to it.

Landforms such as limestone caves, large sink holes, natural ponds and lakes, waterfalls and overlooks all provide interesting diversions for the hiker.

Natural sounds are an important part of the trail experience. Find the best places to hear sounds of wildlife (animal, bird and insect), waterfalls and the sound of wind through the trees.

Treed northern slopes are ideal for cross-country skiers, as snow will stay longer into the spring.

Disadvantages

Steep slopes will be too strenuous and unsafe and are difficult to build on, groom and maintain. Smaller dips and turns can also be hazardous, as they break the stride of hikers. Traverses on long and steep side slopes are difficult for hikers to walk on and are expensive to maintain.

Uneven ground surfaces are expensive to even out during construction. If left as they are, they will require snow and grooming for ski trails in winter.

Wetlands and marshes are fine for winter use but in summer will be expensive to build over and difficult to groom due to the organic soil and thick underbrush. They will also increase the cost of maintaining paved surfaces as there is more frost heaving and buckling during winter. Another reason to avoid these areas is the potential damage to the sensitive plants and wildlife found here.

Open fields and lakes are excellent for summer use but in winter are often windswept and very cold from wind-chill factors.

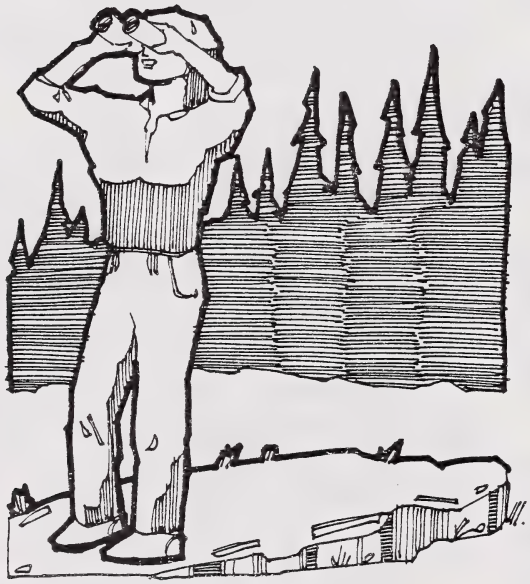
Drainage channels can be unsafe in winter - especially at river bends and entrances where ice is thin. Drainage channels also increase the cost of

construction if they are deep or wide enough to require a bridge.

Thick stands of evergreens prevent snow from reaching the ground. In early spring, snow will melt from the branches of conifers and form ice on the shaded trail below.

Cliff faces pose a danger to skiers during early spring, as they are prone to falling ice.

The Trail Route



Key Factors to Consider

There are several factors to keep in mind when designing the trail route, such as avoiding obstacles and hazards (e.g., trees more than 7 cm in diameter, wet or low areas, loose rocks, thick underbrush and deadfall). You should also avoid designing long straight sections of trail - these quickly become monotonous to trail users.

Since variety is important, you could include interesting or unusual plants or alternate shaded forests with open meadows or open spaces with stands of trees. If your trail follows a ridge, vary its course from side to side to provide a variety of elevations.

Most of all, make sure your trail route provides for:

1. Comfort and Safety: Is there a balance of sun and shade in summer and protection from strong winds in winter? Is drinking water available on long trails? Are benches or logs available for seating at viewpoints and at the top of steep hills?

   If your trail passes by the top of a cliff face, don't bring the trail to the edge to create a lookout point. Include a side path instead. For safety, make sure to include plenty of barriers, railings, secure surfaces and warnings signs.

2. Protection of the Environment and Carrying Capacity: Decide how much use the area can withstand without harming the environment. What will the level of use be and what will the extent of damage be? Is this acceptable? When clearing the trail route, make sure your trail doesn't disturb rare plants, wildlife habitats and interpretive features. Use side trails with dead ends instead. Also, locate trails where erosion will be least likely to occur. Retaining

walls, ditches, "waterbars", bridges and culverts, steps, ladders and switchbacks will all minimize erosion from drainage and traffic.

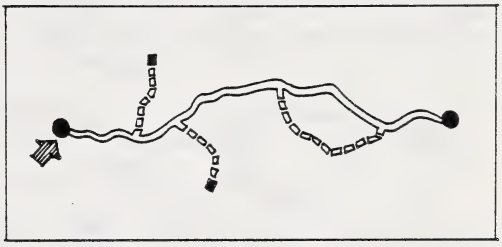
Design Features

Will your trail be functional?

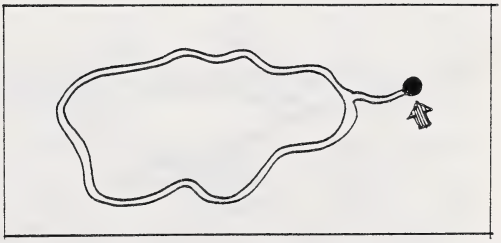
Trail Layout

The next step is to decide on a trail layout that will include the best features of your route as well as make it a pleasant and safe experience for trail users.

Many different layouts are available to you and your designer. The one you choose will depend on the type of trail you are building, who will be using it and their level of expertise. Although the following offers a good guideline for choosing a layout, they can be modified to suit your particular requirements. Use your imagination!



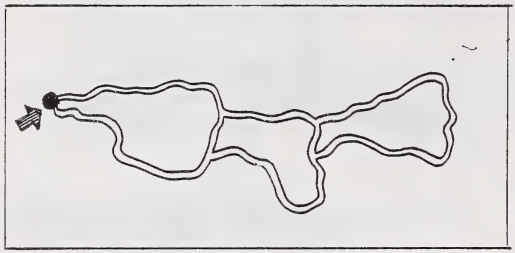
The Linear Trail: This simple trail layout tends to be goal-oriented - the shortest distance between two points, such as from a parking lot to a campsite or swimming area. It is also good for long-distance trails to a backcountry destination. For greater variety, sections or spurs may be added to the trail.

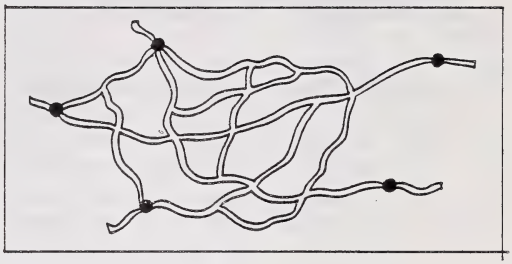


The Simple Loop: This is excellent either as a starter trail or if you plan to include additional trails at a later time. Most suitable for day hikes, the loop is generally

preferable to the linear trail as you do not have to retrace your steps along it. Since this results in less two-way traffic, the loop trail needs less maintenance.

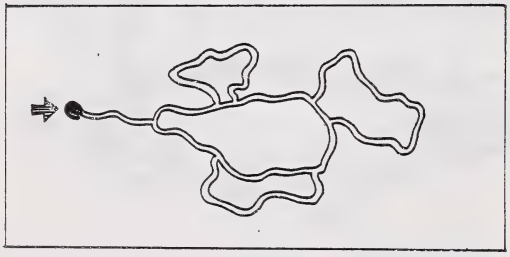
central loop acts as a main trail, with each satellite providing options in terms of difficulty of terrain, solitude and interpretive themes.

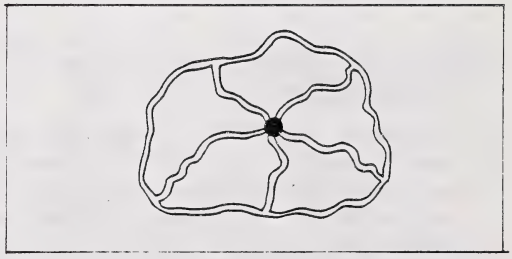




Stacked Loops: Consisting of many simple loops, the stacked loop trail makes efficient use of a small area, providing a variety of hiking experiences. During winter, it allows skiers to cut short a trip if they feel fatigued or run into problems.

The Maze: The maze, like stacked and satellite loop trails, also makes efficient use of a small area. This trail offers a great deal of variety, allowing trail users to explore their own routes at their own pace. Unless it is clearly marked out with signs, though, it can become confusing - especially dangerous during winter if skiers get lost.





Satellite Loop: Like the stacked loop trail, the satellite loop consists of many simple loops, offering a variety of routes and activities. The

Spoked Loop: A combination of the loop trail and the linear trail, the spoked loop allows for short two-way trips or

longer treks. The user who becomes tired while on the spoked loop trail can return to the trail head from a number of different points, all approximately the same distance away.

Tread Width

The tread is the surface of the trail on which traffic moves. How wide you make it depends on the type of trail you plan to build, the amount of use it will receive and whether travel is one-way or two-way. A bike trail, for example, should be wider than most other trails, because it will be used for two-way traffic. On wilderness trails, it should be narrower to minimize damage to the environment.

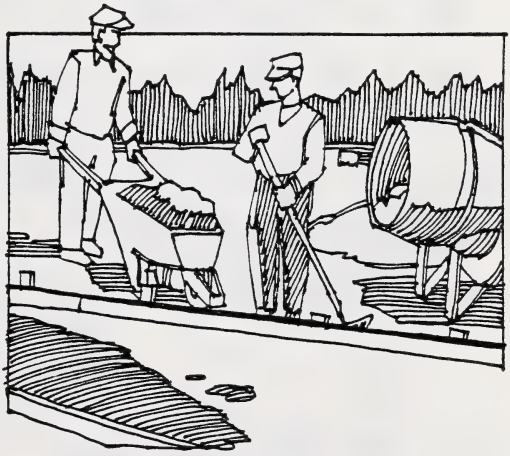
Grade

The term "grade" refers to steepness of a slope. Most trails will have both level and sloping areas. On steep terrain, try to keep the grade to less than 15% for distances shorter than 183 m. Where a slope is short, steep and rocky, look at ways of gaining elevation quickly - a stairway, for example. An even better way is to go around the slope. On long steep slopes that can't be avoided, other options are available, such as "switchbacks". These will be discussed in more detail later.

Vary the steepness of the grade according to the type of activity involved. For example, cyclists prefer gentle grades while hikers enjoy the challenge of a strenuous climb. In all cases, a good rule of thumb is to keep the length of the grade shorter as it gets steeper.

Trail Length

The length of your trail will depend on the type of trail activity, the level of interest and abilities of users and the condition of the terrain. For cyclists and cross-country skiers, the trail should be longer than for day hikers. In rough terrain, keep it shorter, as the trail will be more tiring.



Materials for Foundations and Surfaces

Selecting materials for the surface of the trail tread will depend on a variety of factors. These are: user requirements, which will be different for hikers as opposed to cyclists and wheelchair users; the appearance of the trail surface, which should blend in well with the surrounding terrain; the impact that certain materials and construction machinery will have on the environment; and cost - can you afford certain materials?

The type of soil under the surface will also determine which materials are used. On sandy soils with small amounts of clay, all you really need is a stone dust, such as limestone, mixed with the soil. Where soil is less stable and the trail will be used by cyclists or wheelchairs, a firmer surface is necessary. Extremely wet soils will require a drainage layer - a layer of logs, for example - or some other means for diverting water and protecting the surface materials. Where soils are dry and trail use will be light, you may only need a layer of small branches.

Some of the materials available for surfacing trails include:

Soil Cement and Soil Asphalt: This is a mixture of cement or asphalt and the existing soil. Soil particles are bound together with a seal coat of asphalt, then stone chips are applied to the surface to prevent water penetration. Since relatively little material needs be brought in, cement/asphalt mixtures are one of the most inexpensive methods to surface a trail.

Wood Chips: Available from lumber and sawmills, this material is inexpensive, attractive, quiet and comfortable to walk on. It is most suitable for hiking trails, though not for cycle, wheelchair or equestrian trails. Related materials with the same properties as wood chips are wood and bark shreds and sawdust.

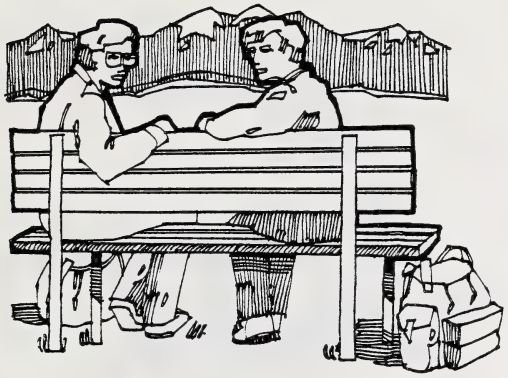
Gravel: This is also an inexpensive material, especially if available locally. It compacts well to give a smooth, durable surface, which can be easily repaired without loss of appearance. A binding layer of stone dust or asphalt emulsion can be added to give increased firmness and smoothness. The main disadvantages are that gravel surfaces raise dust, scatter and require resurfacing.

Crushed Limestone: Similar to gravel, but less likely to raise dust, limestone is rolled to provide a smooth surface. After construction, it must be graded regularly, which makes this a more expensive material to use.

Shale: Fine grades of shale (10-16 mm) can be used to form smooth and compact surfaces, especially if they can be further broken down into fine particles. Like gravel, it is an inexpensive material and requires little maintenance.

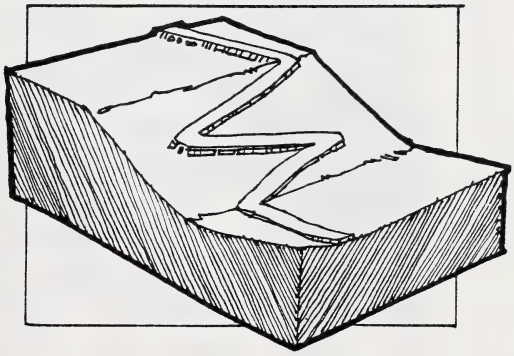
Cement: Produced by mixing gravel with cement and water, this material gives a very hard and durable surface. Requiring only low maintenance, it sheds water with virtually no erosion. Cement is most suitable where use will be intense, such as in urban areas, and for all types of traffic (except horses). Its costs, however, may be too high for some trail budgets.

Asphalt: Less costly than cement, asphalt is still an expensive surfacing material, running up to $37,500 per kilometre. Like cement, it is most suitable for high-intensity use and for all types of traffic except equestrian.



crossing and to use stepping stones. Over wetlands and shallow bodies of water, you could include boulders over fill, logs or decking over posts and decking over styrofoam floats.

Culverts: Another alternative to bridges, culverts can be used to cross small streams where fording will be difficult.



Structures and Facilities

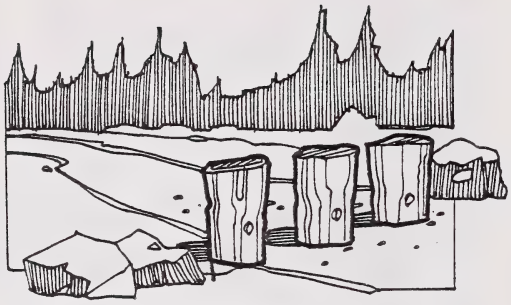
When considering a structure of any type, it is important that it blends in well with its surroundings. Wherever possible, use local materials consistent with the design standards of the trail. And, if you can, avoid building structures altogether, especially on backcountry trails, where trail users prefer undisturbed surroundings.

Among the structures you would include in your trail are:

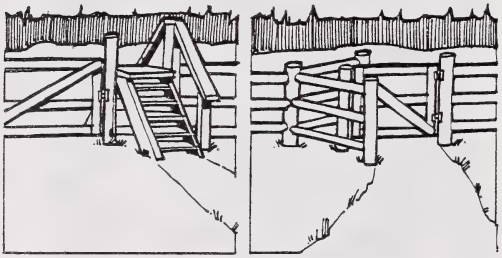
Bridges: Although many designs are available, the type of bridge you choose will depend primarily on the type of trail you are building and the span of the crossing required. These factors will help determine the structural strength, width, materials and the need for railings.

Since bridges are particularly expensive to build, other solutions may be available. A better alternative to building a bridge over a stream, for example, would be to reroute the trail to a narrower

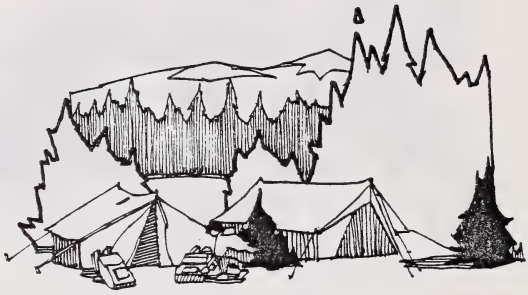
Steps and Switchbacks: These should be used on steep slopes to ensure safety and to prevent soil erosion. Steps are best for short steep climbs and can be constructed of logs, boulders or planking. Switchbacks, on the other hand, are preferable on long, gentle slopes. For trail users who are in good physical condition, ladders make an excellent alternative, as they have a minimal impact on the environment.



Bollards, Barriers, Railings: As the safety of trail users is extremely important, be sure to provide protective structures at hazardous areas. Build barriers at cliff edges and railings on bridges and stairs, particularly if users are inexperienced or handicapped. To block motor vehicles from entering trails, erect bollards and barriers at access points. In areas where the trail crosses farm fences, you could build a stile or dodgeway instead of a gate which can be left open, allowing cattle to escape.



Toilets: A necessary convenience for trail users, these facilities can be simple or elaborate, depending on the type of trail you are building, the number of trail users and your budget.



Campsites: Day-user sites should be within easy walking distance of the trail head, while overnight users prefer a site that is more remote. Try also to situate overnight campsites within a day's travel away from the trail head. Of course, this will depend on the way users are travelling, whether on foot, horseback or by bicyle.

Campsites should also be located so that they take advantage of natural features but avoid hazardous areas, such as the tops of steep ridges or hills, high trees in open areas, fire risk zones and bear habitats. A site near a marsh is also unsuitable due to the mosquito factor. You will, however, want to be near fresh water as a source of drinking water for campers. Streams with rock or gravel beds are best as they will not become muddy with extensive use.

Trail Markers and Signs

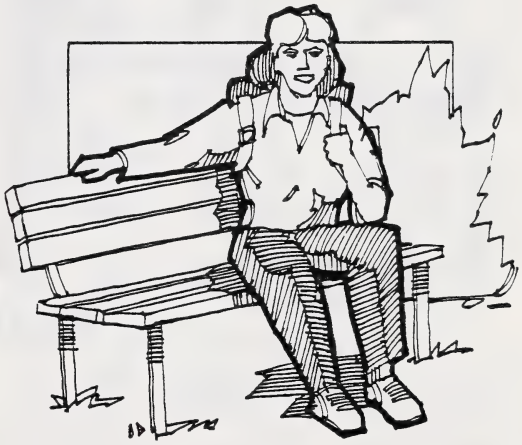
Although every trail will have different requirements for signs and markers, your trail should provide ways to:

- identify trails (names could reflect themes)
- give directions and distances, where other trails are located
- identify attractions
- indicate level of expertise required for use
- identify interpretive trails (see section on interpretive trails)
- warn of hazards

As with other structures, signs should be made of local materials wherever possible. Construct them so that they are permanent or easily replaced, easily seen and identified. They should also be consistent in style. Establish a standard so people are able to recognize your signs.

The wording of your signs should be brief and to the point. Make them non-academic, using simple easy-to-understand language.

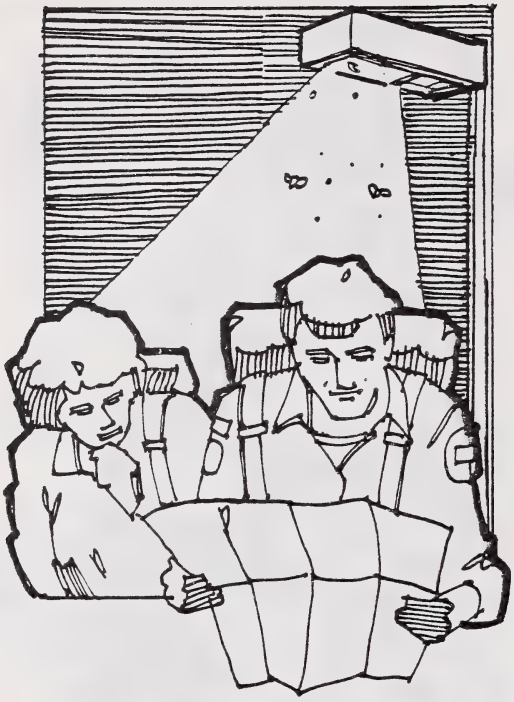
In some cases, you should also consider supplying maps - especially if it is a long trail that enters remote backcountry areas.



Furnishings

Benches, picnic tables, fireplaces and other furnishings are non-essential but welcome features on most trails. When building any type of furnishing, use designs that are simple, functional and comfortable. Try to use natural materials for the finishings.

If you plan to allow fires, build wood stoves rather than fire circles, which can be moved about and create a fire hazard. (If you don't want fires on your trail, make sure you post signs saying so.)



Lighting

Lighting is helpful to trail users for both security and directional purposes. Suitable locations are parking lots, trail heads, washrooms, over important signs and frequently used picnic sites.

In choosing light fixtures, keep design finishes complementary to the overall trail standards. The intensity of the lighting will depend on its location. To reduce maintenance costs, consider sodium or phosphorous lamps for energy conservation and long-life bulbs in remote areas so you don't have to change them frequently. In high-use public areas, lighting should be set high enough off the ground - a minimum of 4 m - to prevent vandalism.

Trail Head/Parking

After your trail is built, how will people get to it? Important features of all trail systems are parking and access points. The way you design these will have an impact on the trail and the trail user.

For example, you wouldn't want a direct access point where rare plants and wildlife could be endangered. Place all access points farther along your trail, out of the reach of casual day users. The same goes for campsites. To prevent campers from being disturbed, keep campsites well away from the trail head.

Where you have high-use areas, such as picnic sites or beaches, keep access to interpretive nature trails well away from heavy traffic. If the entrance to the nature trail is removed to a safe distance, only those who are serious about using it will take the trouble to get there.

Litter Bins

For ecological reasons, your trail should include litter cans and garbage bins. These should be provided at trail heads, picnic sites, rest areas and campsites. They should be sturdy and scavenger-proof since garbage can be harmful to wildlife and vegetation. To minimize problems with garbage, all litter cans and bins should be serviced regularly.

On remote sections of the trail, try to encourage a philosophy of "packing-in/packing-out", something which is done by most experienced and conscientious hikers.

To Test ... Or Not to Test

After inspecting the route and considering all the design options open to you - and especially before committing yourself to paper with a design - you may need to carry out a series of tests.

Since testing is quite expensive, first see if there is any existing information you can use (see the "Natural Resources Information Directory" from Energy and Natural Resources). You might also be able to consult with local "experts" who have designed and constructed similar work in the area. Otherwise, you will have to contract a firm that specializes in testing. Because of the cost factor, it is advisable to limit testing to problem subgrade soils for paved surfaces.

Your tests may include analysis of soil for moisture content, organic content, texture and structure. This will tell you if the trail is capable of handling large volumes of traffic and show which areas are prone to erosion. Other tests could include those for ground water, drainage and slope stability. Vegetation must also be examined for rooting depths (how exposed the roots are) and pruning capability. Water quality should be tested for drinking and/or swimming. Finally, if the trail runs beside a stream, try to determine if sediment will fall into the water as a result of construction and damage fish habitats.

Design — Back to the Drawing Board

Once you have evaluated all alternatives on your concept plans and selected a final route, you're ready to begin preparing construction drawings and guidelines (also called "specifications"). At this point, you can still make final adjustments to the design in the field if you discover they are needed.

The preparation of construction drawings should be done by a landscape architect or engineering consultant. The final trail layout should be shown as a scale drawing - on a 1:500, 1:1000 or 1:2000 scale, depending on the size of the area covered. As well as indicating how the trail will be aligned, the drawing(s) should show the location of significant natural and man-made features, furnishings, structures and facilities such as bridges, culverts and steps. These drawings and specifications should also show methods of construction, materials, typical cross-sections of the tread, clearing limits on trail right-of-way and special treatments for any unusual conditions.

PHASE III: CONSTRUCTION

How Much Will it Cost?

Now that the design phase is finished, you're ready to begin construction. This is the time to establish all final costs for materials and labour. Look at the back of the book under "Trail Costs" for more detailed information on how to prepare a construction budget.

At this point, you should consider whether you have enough money to go ahead and build everything the design calls for. You may have to raise more money, revise your design or build the trail in phases as additional funds become available.

One way of saving money is to use volunteer labour under the supervision of an experienced crew leader. Another possibility is to divide the work between paid and volunteer labour. Have your volunteers take on simple tasks such as the finishing work on structures - assembling benches and signs, painting, staining, etc.

Get it in Writing!

Once you decide how the work will be done, the next step is to hire a contractor who will direct the work. When hiring any outside consultants, keep these rules firmly in mind:

- get competitive proposals from at least three sources
- put everything in writing

Obtaining three or more competitive proposals allows you to select a firm whose costs are in line with your financial resources. Identify your requirements in writing and in detail by listing all materials, labour, professional time and the results you expect to receive. Then, go over those requirements in a briefing session, changing the written document as necessary.

Proposals and cost estimates from the contractor should be submitted to you in writing and in full detail. Again, go over these with the contractor and make any necessary changes in writing. After you've selected a contractor, have a final briefing session to make sure any questions are cleared up before construction begins.

Getting Started

Gathering Your Crew

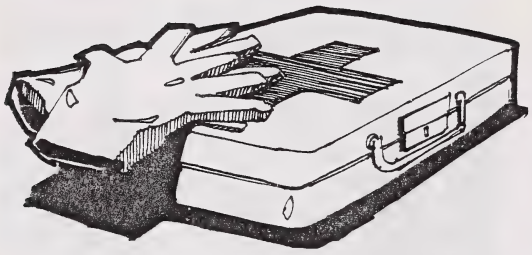
A small, well-organized crew with the proper tools can get more done than a large crew that is disorganized and poorly equipped. Hire people who have experience in trail building and designate as crew leader the person with the most knowledge of trail building techniques and construction management.

The crew leader will be responsible for job assignments and ensuring that an adequate supply of tools, supplies and first-aid equipment is on hand. Before construction begins, make sure he or she is familiar with the trail design and the route. Then, have him or her brief the crew on proper construction procedures, including fire-fighting.

Under the crew system, each crew member has a specific responsibility - such as cutting large trees, pruning light brush or clearing refuse. As much as possible, rotate duties so that each person keeps busy and stays interested in the work. This is especially important if you're using volunteer labour.

Safety First!

Because you will be working in a remote area, crew safety and a knowledge of first aid are essential. All crew members should wear proper clothing, such as hard-toed boots and gloves. All applicable rules on the use of hard hats, power-saw aprons and restraining ropes should be strictly enforced. Finally, make sure someone on the crew is trained in first-aid procedures.



Tools You Will Need

As with any type of work, get the right tools for the job. The basic hand tools you need will include:

- Lopping shears, used to cut branches or small saplings up to 2 cm in diameter.
- Pruning saws, used to cut branches and saplings over 2 cm in diameter.
- Pulaski or Forester's axes, excellent tools for removing stumps, roots and rocks and for digging the trail tread along graded areas.
- Fire rakes, used for removing forest litter from tread surfaces to expose soil.

If you are building up a prepared surface, you will need mechanized equipment. A major problem with construction equipment in wilderness areas, however, is that it tends to be awkward to manoeuvre. Carelessly handled, machinery can damage trees and badly rut trails. To minimize these problems, match equipment to the width of the trail and right-of-way (at least 50 cm) and prevent heavy machinery from travelling over the roots within the dripline of the trees to be preserved. Where you need a grader, you might increase the right-of-way up to 3 m. The extra width can be reseeded later.

Staking

NOTE: Before you start staking the trail and especially before you do any digging, call this toll-free number to find the location of all buried cables and pipelines:

Alberta 1st Call
1-800-242-3447

Staking is the last step before construction begins - make sure the trail follows the best possible route by including yourself or the crew leader on the staking crew. That way, you can be involved in last-minute field changes, to save any outstanding trees and natural features along the trail corridor. Identify them with flagging tape.

Start by marking the centre line of the trail with stakes. Where you encounter steep hills and curves, keep the distance between stakes closer to eliminate any confusion about where the trail is to be cleared and excavated. Then, prior to construction, offset the centre-line stakes and ensure that offset stakes will be protected once clearing begins. At the same time, mark any structures, surfaces and utility lines you wish to protect. To prevent injury to the public, make sure you have adequate construction barriers and warning signs.

Clearing

The next step is to remove all brush along the route you have marked. As you begin clearing, try to cut only what is absolutely necessary to provide for safe, umimpaired movement along the trail. You'll minimize damage to the environment and, with a narrower right-of-way, ensure that the trail will be easier to maintain.

Where you must cut, try to save the largest trees, especially mature spruce. Instead of completely cutting them down, trim the lower branches. Cut any large living branches cleanly - use a pruning saw, not an axe - flush with the tree trunk. This reduces the possiblity of a trail user falling against a projecting branch stub and being injured. To discourage insects and disease, you can cover scars over 2.5 cm in diameter with asphaltic tree dressing.

When you remove trees along the right-of-way, cut them flush with the ground, using a saw rather than an axe. Stumps on the right-of-way should be left in place with as few signs of cutting as possible. Stumps on the tread surface can either be completely removed or cut below the level of the trail with a Pulaski or Forester's axe.

Prune shrubs back from the edge of the tread to a maximum of 60 cm. Smaller branches, twigs and vines can be removed with lopping shears. If you find any large protruding roots, dig them out. On slopes that will be graded, leave roots for removal later during the tread construction to minimize erosion. You should also avoid the use of herbicides for killing root systems, as they can injure other plants in the area.

Clearing heights will vary depending on the type of trail you are building. Generally, they will be lower for hiking trails - about 2.5 m - and higher for ski, bike and equestrian trails - about 3 m.

What should you do with the leftovers? This depends on the type of debris involved. All inorganic wastes should be removed completely away from the site area. Take small trees and large branches well off the trail, then cut up and scatter them, rather than putting them all into one pile. Larger branches and tree trunks, though, can be cut and used for firewood or for constructing bridges and steps. Avoid burning wherever possible and never throw anything down a slope - doing this can promote erosion.

Building the Trail

Preparing the Base

After clearing, the next step is to grade and build the tread of the trail. How you go about this will depend on the kind of trail you're constructing and the conditions you run across. In all cases, though, make sure the tread will provide firm, level footing and adequate drainage along its entire length. To do this, excavate any soils - organic soils, for example - that are unsuitable for the trail surface or as a base. Next, backfill with granular materials or firm soils and grade the tread by crowning or crossfalling it to ensure positive drainage (4 cm per metre of tread width). Then, blend the tread into the existing grade.

When excavating, save the topsoil you remove for reseeding later (see "Landscape Rehabilitation") and store separately from subsoils.

Unsurfaced Trails: For trails that will have a natural surface, remove the largest fallen trees and branches and any materials that are too deep for walking. Remove rocks if they obstruct the path and if you want an even surface for wheelchairs and bicycles. Otherwise, let them sit. Exposed rocks add to the natural look and feel of the trail and make good footholds on hillsides.

Where soil is soft and likely to erode, dig it out and replace it with firm soil or granular materials, such as sand and gravel. Grade the surface so that it has a crown built up to 14 cm for every metre of width.

Surfaced Trails: First, remove leaf litter and surface soil from the tread area. Then, excavate a base to the depth that will be required by the type of surface you will be using. Make sure you save the excavated topsoil for revegetation afterwards on the right-of-way.

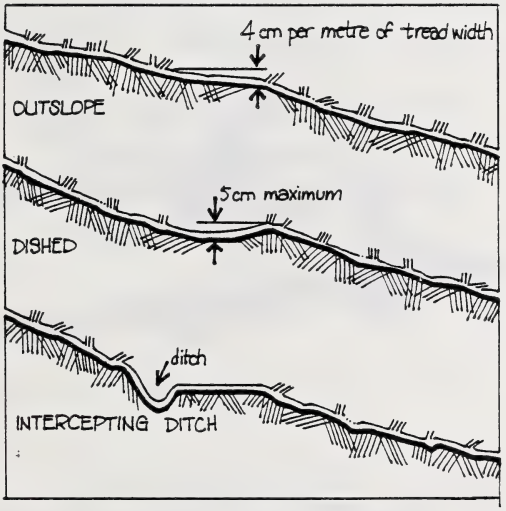
While digging, cut back small roots to the trail edge to prevent growth, but leave large roots in the ground if cutting them will endanger the tree. All cuts should be made cleanly, flush with or just below the ground. Finally, remove all protruding rocks from the tread.

Next, compact the subsoil to provide a firm base for surface materials. How much you compact will depend upon the type of subsoil and the

surfacing material to be used. Generally, compacting up to a 95% dry density is adequate.

If there are soft spots in the subgrade, consider using a filter fabric covered with pit run gravel. Made of porous woven nylon or other synthetic fibres, this fabric improves load-bearing capacity, holds the soil in place and allows moisture to drain through.

When using asphalt as a surface material, treat the base to prevent weeds from growing through the bed of the trail after construction. Use a herbicide and try to prevent the spray from drifting to other vegetated areas.



Treads Built on Slopes: Where the trail crosses a steep side slope, grading the tread will be necessary to prevent drainage problems and erosion. How the trail is cut into the slope will depend on the amount of rainfall in the area, plant cover, soil moisture content, and the type of soil encountered.

You can build up the tread with fill to outslope at 4 cm per metre of trail width. If the trail is dished, hollow out to a maximum of 5 cm at the centre of the tread. On level graded trails, dig an intercepting ditch lined with gravel above the trail itself to catch runoff. To prevent soil from sliding into the ditch or onto the trail, round off the shoulders above the excavation. Finally, spread topsoil and mulch above and below the tread to encourage plant growth.

Building Structures

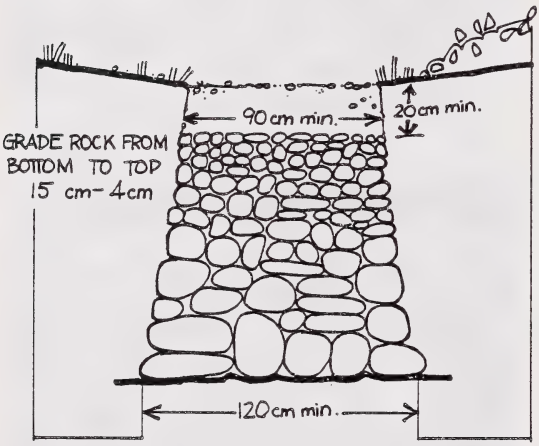
Structures are necessary not only for user comfort and safety but to solve problems of drainage, grading and slope retention, as well as to provide access across bodies of water. As mentioned earlier, existing materials can often be used to build structures such as bridges, waterbars and steps. Be sure materials are consistent with your overall design details.

To prevent wood decay, consult with a designer, landscape architect or building material supplier for advice on chemical preservatives. You can further minimize wood decay by keeping wood members clear of ground contact, for example, placing concrete footings underneath to allow air flow. Then caulk and seal all joints and fastenings, and use only galvanized

hardware. To allow for ventilation and drying, space boards and planks apart and bevel them for drainage.

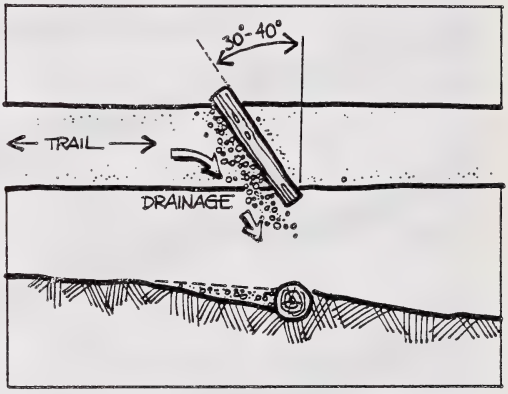
Drainage

Where erosion is most likely to occur, you'll need to build structures for proper drainage control. This is one of the most important factors in trail construction, as erosion can quickly ruin many sections of your trail - especially during spring runoffs and heavy rains. These structures include:



French Drains are effective devices for diverting underground springs. These are simply ditches filled with washed rock and covered by topsoil.

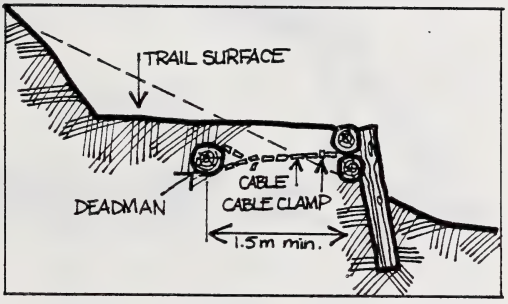
Grade Dips are deflections in a trail to divert surface water from the trail. They are used instead of waterbars when a smooth tread surface is required. Place grade dips at frequent intervals to prevent water from building up and eroding the trail.



Waterbars are used to divert surface runoff from very long or very steep slopes where grade dips would not be adequate. Constructed with 3-4 cm diameter logs or rocks laid at an angle to the flow of water, they should be set below the grade.

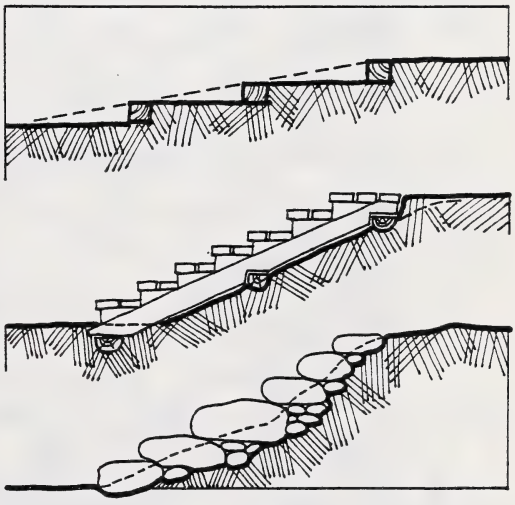
Culverts are used to catch or divert runoff. They can be installed over small streams where a bridge would be too expensive but where fording is too difficult. Use only culverts that are made of galvanized metal large enough to accommodate spring runoff. They should be no smaller than 45 cm by 30 cm to reduce the chances of plugging and to make cleaning easier; no larger than 125 cm by 80 cm to reduce the height of the crossing. In every case, make sure the culvert is large enough to allow proper drainage. Consult with an engineer on the options available to you.

Erosion Control



Retaining Walls should be built on a slope steeper than 45 degrees or a 1:1 angle. As with other structures, use natural materials, such as boulders, railroad ties and treated timbers for low walls. Where higher walls are required, use timber cribbing, reinforced concrete or masonry. To prevent moisture build-up, you may need to install weep holes and drain sumps. Consult an engineer if your retaining wall will be higher than 90 cm.

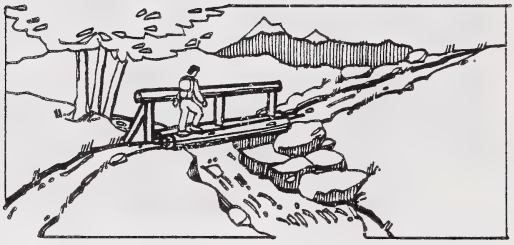
Switchbacks prevent erosion on hillsides, while allowing trail users to go across the slope rather than straight up it. To work effectively, they should be properly graded with the addition of waterbars constructed of rock and embedded steps. Minimize shortcutting across the slope by installing railroad ties and rocks or planting shrubbery above the structure.



Steps ensure safety as well as provide erosion control on very steep slopes. Where many steps are required, build several flights with long landings and handrails for added security. To determine the height of the step riser, use this formula: R (riser height) x T (tread depth) = 450. If the step is 45 cm deep, the height would be

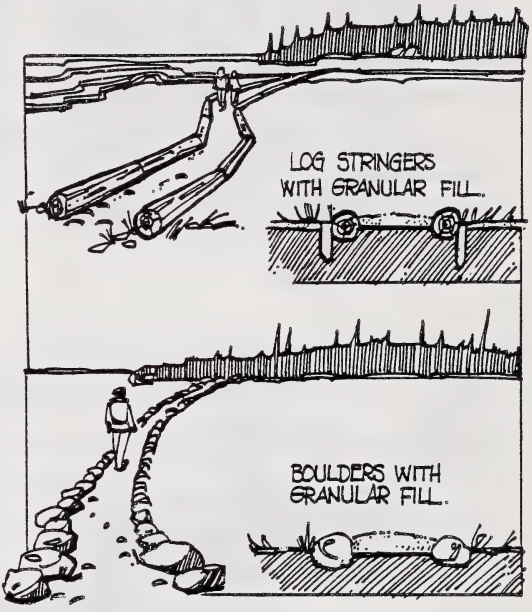
10 cm. Materials for step construction include logs, timbers and boulders.

Water Crossings

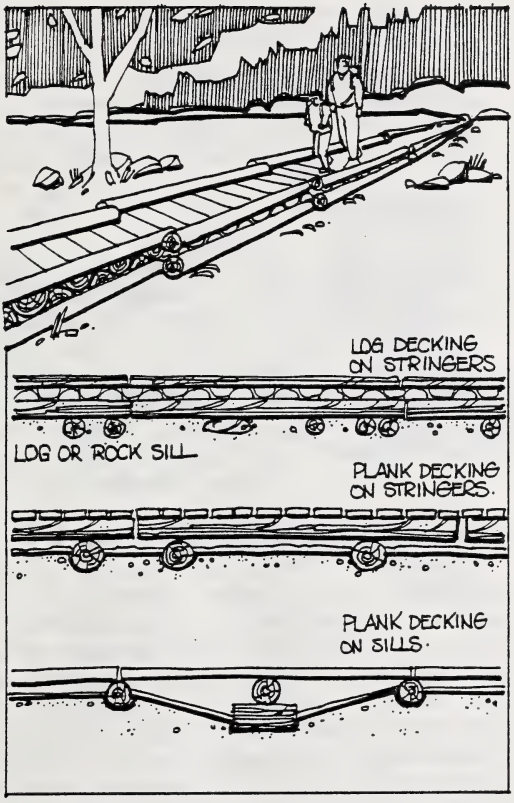


Bridges will be required wherever a culvert or fording is inadequate. Set all bridges at right angles to the stream or river crossed. At minimum, the deck should be raised a few feet above the water, especially where there are fast currents, and should have safety railings. In some cases, a simple two-log bridge with a railing will be all that is required. In other cases, a more elaborate bridge with footings, sills, stringers, decking and handrails will be needed. Consult with an engineer to decide which type of bridge is best for your requirements.

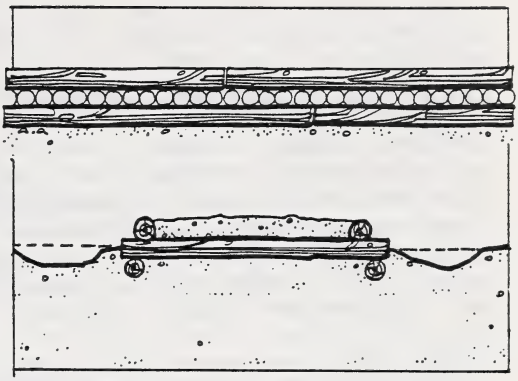
The load capacity of a bridge structure will depend on the use it is put to. But, whether it is designed to carry horses or hikers, good workmanship and appropriate materials will make the difference between a long-lasting bridge and one that needs extensive repairs in a year or two.



Turnpikes can use be used over marshlands or areas that become wet during rainfalls. Turnpikes consist of elevated foundations of soil or rock with sides that are retained by railroad ties and rock edging to support the trail.



Puncheons are sawn, treated timber or logs used to elevate the trail above the ground over small wetland areas. They consist of a plank deck that is set over lengthwise logs ("stringers") with enough clearance underneath to ensure proper drainage.



Corduroy is a technique used to cross marshy areas. Basically the same as puncheon, but less permanent. It is a lengthwise bed of logs covered with flattened soil.

Surfaces

Now you're ready to apply the material you selected for the surface of the trail tread. On light-use trails, construction will require a minimum of time and effort. For trails that will receive heavy traffic, this stage is one of the most important. The proper application of the surfacing material will determine how long the trail lasts and how expensive it will be to maintain.

Wood Chips: Compact into place to a depth of 75-100 mm. Trail edging may be needed in some areas to keep the surface in place. No base materials are required, except in areas with soft soil. Unstable soils should be excavated and replaced with firm soil or granular materials such as gravel.

Gravel, Limestone, Shale: Compact into place to 95% maximum dry density. Depending on soil conditions and level of use, a base material may not be necessary, especially if the subgrade is free draining. However, on soft subbases, you will require a minimum 7-10 cm base of compacted pit run gravel. The surface itself should be approximately 10 cm deep, then graded to crown or crossfall. Trail edging is optional as these materials are less likely to be scattered.

Cement/Concrete: While excavating, be sure there is no free-standing water or soft spots. Where you find soft spots, dig out the organic materials or topsoil and replace with firm soil, sand, crushed stone or gravel fill. A well-compacted subbase of gravel to a depth of 10-15 cm is recommended.

The minimum thickness of the concrete layer should be 10 cm. Once poured, it must be smoothed over to fill in any low spots. If the trail is wider than 1.5 m, use wire mesh reinforcing. Do not overwork the concrete, however, as this will result in a less durable surface. Let the concrete stand for a week so that it may cure properly.

Soil Cement: This material consists of 8-12% cement, fine-grade sand and water. The cement is mixed in place with the soil to the depth required. After water is applied, the cement and soil are mixed, compacted and cured. Note that soil cement must have a proper seal coat over a layer of emulsion to ensure durability.

Asphalt: There are basically two types of asphalt available for tread surfacing - "hot mix" and "cold mix". Hot mix is most often used for road surfacing as it gives a smooth surface; cold mix is most often used for patching. The advantage of using cold mix for trails is that it can be kept soft as long as the solvent is kept in the mix (hot mix is unworkable once it cools). This allows more time for laying the asphalt; its use is not restricted to areas near mixing plants; and you need only small trucks to bring it in. Like cement, asphalt must be poured over base layers of compacted granular material to prevent frost heaving and settling.

Landscape Rehabilitation

Once the trail surface has been laid, your work isn't done yet. An important part of the construction process is to restore the trail environment.

The first step in landscape rehabilitation is to prepare a base for reseeding. The soil you saved during construction will be adequate in most cases. Use subsoils to fill in depressions and build berms or mounds. Use topsoil for seedbeds. If it does not consist of good quality black loom, you can make a topsoil mixing two parts clay, two parts sand and one part peat.

Next, spread the topsoil evenly to a depth of 10-15 cm. The resulting seedbed should be granular, firm and slightly moist.

Reseeding

If your trail will be kept in a natural state, reseeding is simply a matter of spreading the topsoil you saved during excavation. It already contains seeds from the plants native to the area. If your trail will be landscaped, however, you'll need to buy seed mix. Consult your district agriculture office or trail consultant on the type of seed mixture that is best for the conditions along the trail site. (Except in limited areas, sod is generally too expensive for most trail budgets.)

The best times for seeding are late May to June or the beginning of September. Seeds can be applied by hand with a spreader over small areas or with a hydro spreader over larger areas. Apply half in one direction (e.g., north-south) and half in the other direction (east-west). In most cases, plant to a depth of 1.3 cm.

Should you fertilize? Before deciding, take a soil sample and have it analyzed at the:

Soil and Feed Testing Laboratory
6th Floor, O.S. Longman Building
6909 - 116th Street
EDMONTON, Alberta
T6H 4P2
Phone: 436-9150

After seeding, it is essential to water the seedbed frequently. Moisten the topsoil lightly without saturating it and repeat every two or three days before the ground has dried out completely.

PHASE IV: MAINTENANCE

Congratulations! At this point your trail is finished. And, what a rewarding experience it is to see people actually using your trail, enjoying the beauty and splendour of its natural setting. You and your group deserve all the credit that's coming to you.

But you're not done yet. Keeping up the trail is just as important

as building it. To prevent your masterpiece from becoming an eyesore, you'll need a maintenance program and people to run it.

Maintaining your trail is really a matter of good housekeeping. It helps to ensure that the trail is pleasant and safe to use. Before starting your program, you will need to hire two or three people. If the trail will be open only during the summer months, you could rely on volunteers or students instead.

The first step is to draw up a maintenance schedule. It can be developed with the help of a parks consultant or warden who knows the ins and outs of trail maintenance. Design a trail log with checklists of jobs that need to be done. To allow for the evaluation of the trail's condition, there should be room for the comments of maintenance staff. Here's what it could include:

Spring

1. Clean Up: For safety reasons, clear all debris left over from winter as soon as trails are dry. Large fallen trees that can't be removed right away can be left on the trail if you cut a gap through them. Sweep paved trails; rake shale or gravel. If you can, join with an established Spring Clean-Up program. These are often organized by service groups.

2. Clear New Growth: Every year, cut back branches leaning into the trail right-of-way. Mow turf along trail edges or treat encroaching grass and bush along the sides of trails with herbicide. Trim trees and shrubs.

3. Repair Erosion: Although this should be watched carefully throughout the warm summer months, spring is when erosion is most likely to occur, particularly during runoff. Trails will need patching or regrading; drainage controls, such as ditches, waterbars and culverts, must be inspected for clogging and be cleared. New channels caused by runoff (check after heavy storms) should be filled and reseeded, or redirected to divert runoff. If damage is serious, don't let it get worse or out of hand! Close that part of the trail to give it a chance to recover. Ask yourself if the tread surface is up to the demands placed on it - maybe a more durable one is the answer.

4. Check Structures: After winter, inspect all hand railings, steps and stairways and bridges. This is for safety's sake - you could be liable if there is an accident! Check for vandalism on campsites, especially in washrooms, and repair it immediately. In cases of serious damage, fires for example, you may have to hire a contractor to do the repair work.

5. Repair Signs, Markers and Furniture: Check and repair before the trail season begins.

6. Maintain Campsites: Repair any damaged structures, cut back new plant growth and remove dead trees. Depleted firewood supplies should be restocked. Check latrines and pit toilets and dig new ones if needed; fill in old ones.

Summer/Fall

1. Control Vegetation On and Off Trails and Repair Tread Surfaces: Apply herbicides on shale or gravel trails to keep down growth. On paved trails, use a sterilant. If the new growth is small, try applying a herbicide, then heat the asphalt with a torch. Using a maul, you can then flatten the new growth back to its original level. On right-of-ways, keep grass growth back to its original level. On right-of-ways, keep grass mowed beside trails or it will eventually end up on the tread. Use herbicides only if there is growth on the tread; mow beside the trail once or twice a month.

2. Clean Trails: Throughout the warm months, clean up litter on trails and empty waste receptacles. After the leaves have fallen, sweep or rake trails again.

3. Clean Campsites: Repair damage from vandalism, replace firewood and keep washrooms clean thoughout the summer and fall. If there is major damage, check into insurance. Find out how much "deductible" is practical for your trail.

4. Check Structures, Signs and Furniture: Check and repair them on an ongoing daily basis. Keep a constant watch for loose railings, steps, barriers, etc. Make safety your maintenance crew's motto.

Winter

1. Set Track for Cross-Country Trails: Use a dual track snow machine and a groomer/track setter to prepare and groom ski trails. (Contract this service out to avoid capital costs.) To groom hiking trails, use the snow machine only without the track setter. Throughout winter, make sure that hikers and snowshoers have separate trails and are not using cross-country ski trails (see "Cross-Country Ski Trails").

Combatting Vandalism

Vandalism will be a problem you'll inevitably run into and can probably do little to eliminate completely. (If only human nature were like Mother Nature.) However, there are steps you can take to minimize it.

The most common forms of vandalism are carving, defacing or misusing such structures as washrooms, shelters and picnic tables. Less common, but still a problem, are graffiti and the destruction of small trees. Repair or replace damaged property as soon as possible. The fewer signs of vandalism there are, the more you reduce the chances of it happening again.

Take security precautions such as:

- police patrols on motorbike or snowmobile
- staff patrols using two-way radios
- public awareness through media and education programs
- the use of bollards, posts and gates to control vehicle access
- encourage volunteer surveillance

Make it a policy to prosecute vandals if you catch them. Even though this might make you unpopular in some quarters, you must build a reputation for not tolerating vandalism on your trail system.

Maintenance Equipment

Depending on the type of trail system you will be operating, you will need equipment to carry out an effective maintenance program. A mixed-use bicycle and hiking trail, for example, would require:

- 1 all-terrain vehicle and trailers
- 1 tractor with broom attachment
- 1 water truck
- 1 scooter
- assorted mowers
- 4 light trucks
- assorted sprayers, small tools, etc.

Nature Trail Evaluation Sheet

To be completed by the 15th of each month.

Date: _____ Name of Trail: _____

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PHYSICAL EVALUATION (Condition as the public would see it)

1. Tread	Excellent ( )	Good ( )	Fair ( )	Poor ( )
2. Drainage	Excellent ( )	Good ( )	Fair ( )	Poor ( )
3. Trailside	Excellent ( )	Good ( )	Fair ( )	Poor ( )
4. Structures	Excellent ( )	Good ( )	Fair ( )	Poor ( )
5. Signs/Furnishings	Excellent ( )	Good ( )	Fair ( )	Poor ( )
6. Traffic Services	Excellent ( )	Good ( )	Fair ( )	Poor ( )

Specific problems. Attach map or describe location.

a) _____
b) _____
c) _____
d) _____

Which ones are emergencies? _____
_____

Suggested improvement or relocation.

a) _____
b) _____

==========

INTERPRETIVE EVALUATION

1. Directional Signs: Excellent ( ) Need paint ( ) Replacement ( ) (Locate on map)
2. Tree Labels: Adequate ( ) Need more labels ( ) Repairs ( )
3. Seasonal Nature Signs: Damaged ( ) Not up ( ) (Locate on map)
4. Outdoor Exhibits: Need repair ( ) Explain _____
_____
_____

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BY-LAW WARNINGS

1. Notices to Visitors: Need repair ( ) Not up ( ) (Locate)
2. Security Personnel: Needed ( ) Time and Reason: _____

==========

OTHER COMMENTS

_____
_____

Signature of patrol staff _____

TRAIL TYPES

If you have read all the material in Recreation Trails up to this point, you should have a fairly clear picture on how to plan, design and construct nearly any kind of trail. Now, you'll have the opportunity to see how this process applies to specific trail types.

Basically, there are four types of trails covered in this section of the manual: Hiking Trails, Cross-Country Ski Trails, Bicycle Trails and Equestrian Trails. Each has a character of its own. The width and height of the trail route, the surface of the trail tread, signage, facilities needed - even what people find most interesting - will be quite different from one trail to another.

All trails, however, should ensure the comfort and ease of movement of the trail user, be safe, respect wildlife and plant life and offer the most aesthetically pleasing experience possible.

You may be considering several types of trail or one trail that is to be used for several purposes: hiking, horseback riding and cross-country skiing in winter. In the following sections, you'll learn about each type in greater detail. Compare what you need for your trail project and see where you can combine facilities. Then, use the information given here to plan how to build your own trail.

Hiking Trails

In this section, you'll learn about the nine varieties of hiking trails that are available to you. Each is similar but attracts different users for different reasons.

All the hiking trails described here are alike in certain ways. They make use of less expensive tread surfaces (leaf litter, wood chips, shale, gravel or limestone), require little clearing and have a minor impact on the environment.

Wilderness Trails

One of the main characteristics of wilderness trails, aside from their rugged natural setting, is the type

of user they attract - usually an expert, more experienced hiker.

To preserve the wilderness experience a trail of this type offers, only small groups of hikers should be encouraged. The wilderness trail user wants few reminders of civilization - and that includes other people! Other sights to be avoided are views of towns, roads, railroads, power lines or any kind of industry.

The trail itself should be left as undeveloped with campsites as possible. To reduce the human impact on the trail environment, keep the width of the trail narrow - between 45 and 90 cm - with only a minimal right-of-way to either side. When constructing the trail, most rocks and all the soil can be left in place.

Because fewer facilities will be provided, and since much of the trail route will enter remote areas, advise hikers not to disturb their surroundings. They should know - and most experienced hikers do - to avoid shortcuts, leave vegetation standing and take care with campfires. If you are not providing fire pits, have trail users carry portable stoves instead.

Wilderness hikers tend to be more physically fit. When designing this type of trail, it's fine to include more difficult terrain, such as steeper slopes with ladders instead of steps. The trail could also be long enough for two or more nights of camping with campsites spaced 8 to 10 km apart.

The recommended layout for wilderness trails is the loop or linear trail with side paths leading towards points of interest (scenic views, rare plants, etc.)

Guidelines:

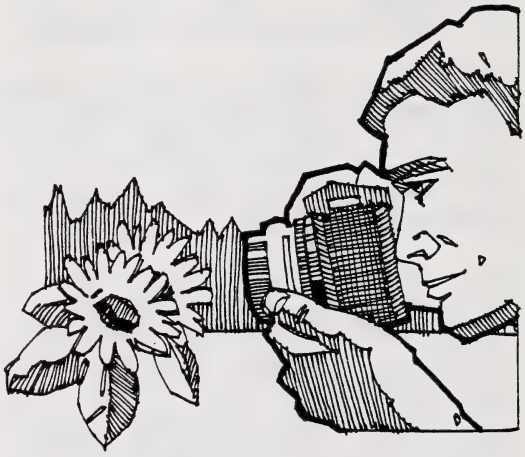
Layout:
- Linear or loop

Length:
- Allow for two nights of camping or longer

Grades:
- 0-10 percent
- Maximum sustained grade: 15 percent
- Maximum short pitch: 30 percent on 30 m distance

Width:
- 45-90 cm

Right-of-Way Clearance:
- To a height of 2.5 m
- For width, see CONSTRUCTION re Clearing



Backcountry Trails

Closer to home, backcountry trails reproduce much of the experience of a remote wilderness trail, although the concern for avoiding signs of civilization here isn't as great. As there is likely to be more

traffic on this type of trail, you'll need to include more elaborate structures such as bridges and stairs with railings. The trail should also be easier going with fewer steep climbs along the way to accommodate a wider range of users. On the other hand, you'll want to retain some of the rugged character of a wilderness trail by excluding such amenities as picnic tables and viewing stations.

To minimize damage to the environment the trail should be kept narrow (45-90 cm) and have a natural tread surface. Recommended layout, as for wilderness trails, can be either the loop or linear type with side paths.

The length of the trail should allow for treks of at least two days, with campsites provided at closer intervals. These, however, can be more elaborate than in wilderness trails, with wood stoves, toilets and even shelters provided. Since privacy is not as great a concern, individual sites can be spaced closer together.

Guidelines:

Layout:
- Linear or loop with side paths

Length:
- Allow for two nights of camping or longer

Grades:
- 0-10 percent
- Maximum sustained grade: 15 percent
- Maximum short pitch: 30 percent on 30 m distance

Width:
- 45-90 cm

Right-of-Way Clearance:
- To a height of 2.5 m
- For width, see CONSTRUCTION re Clearing

Structures:
- Shelters

Facilities:
- Wood stoves, toilets

Frontcountry Trails

These trails are usually found closer to populated areas. They should, therefore, be developed to give larger numbers of people of all skill levels the opportunity to enjoy a wilderness experience.

Routes for frontcountry trails should be made up of sections that provide many points of scenic interest within a day's easy walk - from 8 to 13 km, depending on the terrain, or shorter lengths of 1.5 to 3 km in heavily populated urban areas. A loop or linear layout with many side paths is ideal for most frontcountry trails.

To ensure the comfort and safety of trail users, grades should be less steep and more elaborate facilities such as stairs, bridges, handrails and developed viewpoints are recommended. If you provide campsites, you would also include wood stoves, toilets, picnic tables and, in some cases, running water.

Guidelines:

Layout:
- Linear or loop with side paths

Length:
- 8-13 km (1.5-3 km close or urban areas)

Grades:
- 0-10 percent
- Maximum sustained grade: 15 percent
- Maximum short pitch: 20 percent on 30 m distance

Width:
- 45-60 cm

Right-of-Way Clearance:
- To a height of 2.5 m
- For width, see CONSTRUCTION re Clearing

Structures:
- Stairs, bridges with handrails, viewpoints

Facilities:
- Wood stoves, toilets, picnic tables

Day Use Trails

As you might guess, day use trails offer a wide variety of sights and activities that are available within a day's easy hike. Often, you can provide a day use trail by reserving one loop within an extensive frontcountry trail system.

Since many more people will be using this type of trail, you'll need to accommodate them by making sure that grades are gentler and that structures and signage are more elaborate. You should also be considering the special needs of the handicapped. Slopes should have less than a 5% grade, more railings should be provided on ramps and bridges and smoother, more even surfaces will be required.

Some day use trails can be geared towards more experienced hikers, who will need fewer facilities. However, signs noting these difficult routes should be clearly posted.

Guidelines:

Layout:
- Linear, loop combinations, maze

Length:
- Short loops - 3-5 km
- Long loops - 13 km

Grades:
- 0-10 percent
- Maximum sustained grade: 15 percent
- Maximum short pitch: 20 percent on 30 m distance

Width:
- 45-60 cm

Right-of-Way Clearance:
- To a height of 2.5 m
- For width, see CONSTRUCTION re Clearing

Structures:
- Stairs, bridges with handrails, viewpoints

Facilities:
- Wood stoves, toilets, picnic tables

Urban Trails

Although not necessarily located in urban areas, the level of use these trails receive will be the highest of any trail type discussed so far. And, they will be used by the greatest variety of people: young and old, experienced bikers and beginners and those with handicaps. Your urban trail should accommodate as many of these groups as possible.

The type of layout best suited for urban trails will vary, depending on where it will run, who will be using the trail and what points of interest you are offering. In most cases, the loop form of trail layout is preferred, as it offers the greatest variety of experience in a short distance.

If you make allowances for the handicapped, you'll want a trail surface that is smooth, firm and even: crushed and compacted gravel at a minimum; asphalt if your budget permits it. Traffic likely will be two-way, so count on a trail width up to 2 m. If not, allow a width of 1.2 m. Handrails should be provided on bridges as well as ramps, with wheelstops at the edge of the deck. Also, make sure the decking is evenly spaced and runs lengthwise so that wheelchairs can roll smoothly along the surface.

For other trail users, construct a tread surface that is natural or made of wood chips, shale or gravel. The material you select will depend on soil conditions and intensity of use. You can also extend the length of the trail further, with steeper slopes offering greater challenges along the way.

Guidelines:

Layout:
- Loop

Length:
- 800 m to 5 km

Grades:
- 0-3 percent
- Maximum sustained grade: 5 percent
- Maximum short pitch: 10 percent on 30 m distance
- For handicapped: 0-3 percent
- 8 percent maximum on short pitches

Width:
- 1.2 m (one-way traffic)
- 2 m (two-way traffic)

Right-of-Way Clearance:
- To a height of 2.5 m
- For width, see CONSTRUCTION re Clearing

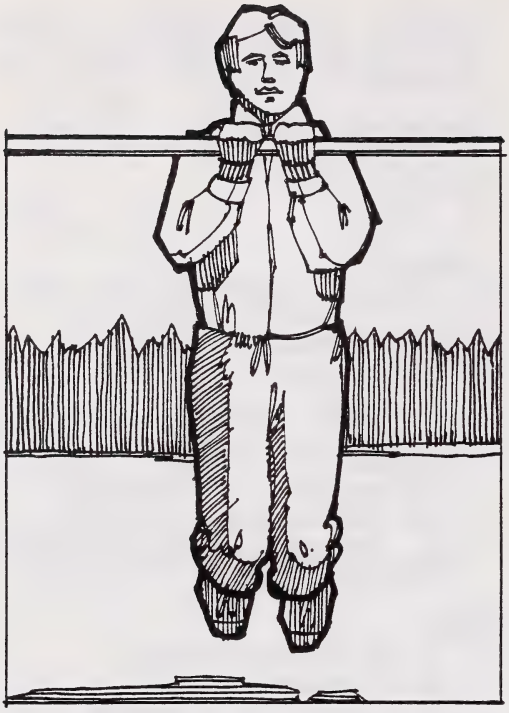
Surfacing:
- Natural, wood chips, shredded bark or crushed stone
- For handicapped: compacted crushed stone, cinders, shale or asphalt

Structures:
- Stairs, bridges with handrails, boardwalks, viewpoints

Facilities:
- Wood stoves, toilets, picnic tables, lighting

Exercise Trails

First developed in Switzerland, exercise trails are a series of exercise stations linked by a pedestrian trail. An excellent way



to promote fitness, this type of trail is all the more enjoyable for the outdoor experience it offers.

As part of a fitness program, exercise trails provide a good balance of muscular and aerobic activities. Ideal for anyone of any age, they allow you to exercise at your own pace without undue stress or strain.

As a recreational facility, exercise trails offer several advantages. They allow for many types of activity: working out, jogging, cross-country skiing and snowshoeing. They can be as simple or as complex as you like, depending on your requirements and budget. And, most are relatively inexpensive to build and less costly to maintain than other types of trail systems.

Many layouts are suitable for exercise trails, although the loop, or a related type, is most common. Single loop trails should offer a variety of terrain and pleasant surroundings with facilities at the beginning and end of the trail for parking and changing. On double or multiple loop trails, the additional loops can offer more strenuous exercises or simply be an extension of the first loop for jogging.

Trail length usually runs from 1-4 km. Trail widths range from 2-4 m. For the surface of the tread, you have a choice of several materials, including a combination of sawdust, sand and shredded bark, wood chips, shale, cinders or pea gravel. Apply to a minimum depth of 10 cm. Dirt is generally unacceptable as a surface material since it tends to become hard packed when dry, muddy and slippery when met. In most cases, a base is not required. Where soil is poorly drained, a gravel base should be added.

Along the trail, exercise stations must provide for warm-ups, peak workouts and a cool-down. They should also be set just off the trail so that exercisers do not impede joggers or skiers. Within the station area, there should be enough room for several people to move around comfortably. You may also consider including benches as rest stops.

Many of the stations will not require any exercise equipment, except for signage showing the exercise to be performed. For warm-ups and cool-downs, include such activities as crossed-arm swings, high stretches, jumping jacks, arm circling, toe touching and side bends.

Peak exercises will require equipment as well as signage. Hurdling, chin-ups, log swings and ramp climbing are a few of the fitness activities for which you will need to build structures. Some you can construct yourself. Other more elaborate structures may call for the advice of a professional designer.

Signage is a very important part of any fitness trail. All signs should be built of the same materials for the sake of consistency. At the start of the trail, they should indicate the trail's name, its length, the time needed to complete the exercises and directions to other facilities. At each station, there should be signs explaining how to perform exercises and warning participants not to overdo a workout.

Guidelines:

Layout:
- Linear or loop combinations

Length:
- 1-4 km

Grades:
- 0-5 percent
- Maximum sustained grade: 6-8 percent
- Maximum short pitch: 13-14 percent on 30 m distance

Width:
- 2-4 m

Right-of-Way Clearance:
- To a height of 2.5 m
- For width, see CONSTRUCTION re Clearing

Surfacing:
- Wood chips, combination of sawdust, sand and shredded bark, shale, cinder or pea gravel

Facilities:
- Signage, benches, exercise equipment, changing rooms

Interpretive/Self-Guided Trails

An interpretive trail highlights natural or historical attractions that might not otherwise be appreciated. It puts people into direct contact with the best resources of a park or a trail.

Interpretive trails can be built either for conducted tours or self-guided tours. Both are similar, except that self-guided trails will necessarily have to tell more of the story, using more complete signage or other interpretive materials. Which approach you take with your interpretive trail will depend on such factors as the remoteness of the route, budget and available staff.

The self-guided trail offers several advantages. Few staff are needed. Visitor hours can be more flexible. And, parents can interpret the trail's features for

their children. An added benefit of self-guided trails is that they can accommodate larger numbers of people in smaller groups.

Interpretive trails designed for conducted tours, on the other hand, allow for greater explanation and clarity. Each presentation can be adjusted to different age groups, and a well-trained tour guide will be able to hold their attention and interest far better than signs.

On both conducted and self-guided trails, the subjects you include can be presented over several trails, each featuring a particular theme: wildlife habitat, plant life, unusual rock formations or interesting environments such as a marshland. Name your trails! Give each a name that reflects its own theme.

The other approach would be to show several related aspects of an entire "ecosystem": how wildlife and plants adapt to different environments, such as wetlands, forests and alpine areas. Another popular theme for interpretive trails is an historical look at your region, showing patterns of settlement over a period of time.

To explain the interpretive features of the trail, you can use one or a combination of methods. You could use signage or markers keyed to leaflets provided at the trail head. You might also consider three-dimensional exhibits and tape recordings that are played at each exhibit or throughout the trail on portable cassettes.

When planning any kind of sign, remember these important points. All signs should be made of the same materials for consistency and ease of identification. Messages should tell separate stories but also relate to the overall theme of the trail. They should be worded in easy-to-understand language. Scientific names of plants or animals can be included, but be sure to feature the commonly used name first. Try also to make your signs eye-catching and entertaining. Long, complicated signs simply lose people's interest.

Another consideration is the design of the trail itself. A good layout is the loop form with side paths or additional loops or other points of interest. Depending on the theme of your trail and the type of terrain covered, your route can vary from less than one kilometre to several kilometres in length. Trail widths can range from 45-180 cm. If your trail is to be self-guided, make it narrower; for larger conducted tours, construct a wider trail. In either case, try to keep interpretive trails away from other types of trails, if there are any nearby, so that people are not distracted by hikers, horseback riders and other trail users.

A variety of surfacing materials is appropriate for the tread, though materials that are easy and quiet to walk on are best. Wood chips, sawdust, shale and gravel are all suitable for trails of this type.

Guidelines:

Layout:
- Loop with side paths

Length:
- 1-13 km

Grades:
- 0-5 percent
- Maximum sustained grade: 10 percent
- Maximum short pitch: 15 percent on 30 m distance

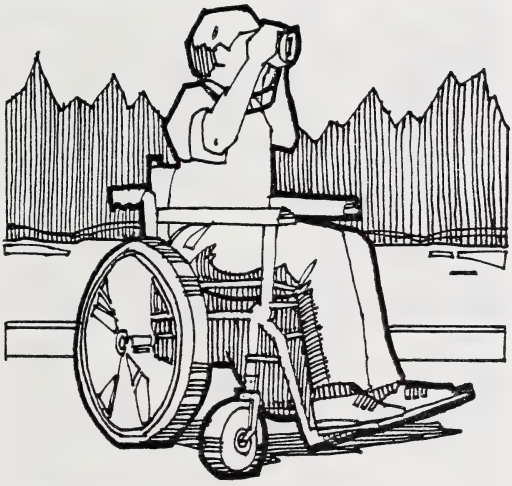
Width:
- 45-180 cm

Right-of-Way Clearance:
- To a height of 2.5 m
- For width, see CONSTRUCTION re Clearing

Surfacing:
- Wood chips, sawdust, shale, gravel

Structures:
- Bridges (some with railings), steps, barriers

Facilities:
- Signs and exhibits, maps, benches, viewpoints



Trails for the Handicapped

In recent years, there has been a growing awareness of the needs of the handicapped. We are coming to realize that many of the limitations they face are often those that we have imposed on them.

This manual has already pointed out how the handicapped can be accommodated on certain types of trails. The most important factor to remember, though, is that tread surfaces must be smooth and even for wheelchairs. Asphalt or cement on compacted gravel is ideal. For the same reason, planks on bridges and ramps should be laid close together, parallel to the length of the decking. And, railings and wheelstops should be extended past the edges of ramps, bridges and boardwalks for safety.

The length and width of the trail are additional factors to consider. In most cases, the route can be as short as 2 km for partial day use or as long as 5 km for full day use, although many people in wheelchairs are capable of travelling much farther. The trail's width should be able to accommodate two-way traffic flow - about 2 m across.

The steepness of the grade is another important factor for people in wheelchairs or for anyone who has difficulty walking. A 2% grade in most areas is fine; 5-8% if the length of the slope covers a short distance.

People with sight and hearing impairments can also be accommodated by providing Braille signs for the blind and distinctive visual aids for the deaf.

Giving the disabled access to your trail can be ensured with a little forethought in the planning stages. Although there are as many special requirements as there are groups of disabled, you can find out where the need is greatest by including representatives from handicapped groups in the planning of your trail. Accommodating them

takes very little additional time and money.

Guidelines:

Layout:
- Loop or Linear

Length:
- 2-5 km

Grades:
- 0-3 percent
- 8 percent maximum on short pitches

Width:
- 2 m (two-way traffic)

Right-of-Way Clearance:
- To a height of 2.5 m
- For width, see CONSTRUCTION re Clearing

Surfacing:
- Compacted crushed stone, cinders, shale, cement or asphalt

Structures:
- Bridges, ramps and boardwalks with handrails

Cross-Country Ski Trails

Although cross-country skiing is an age-old winter activity, its popularity has grown tremendously in recent years. Nearly anyone can master the sport, the costs are relatively low and you can strap on your skis anytime there's enough snow on the ground. In Alberta, that's a good part of the year!

Many wonder why special ski trails should be developed at all, since you can ski nearly anywhere there's enough snow cover. To fully enjoy this sport, though, you need a properly designed and well-maintained trail system that provides challenging experiences for all skill levels.

When planning a ski trail, first decide who your trail will serve and how. Will it be for day or weekend use? Do you plan on using the trail in the summer for other activities? Will it be used mainly by beginner, intermediate or expert skiers? Or, will it meet the needs of all skiers?

More than any other type of trail system, cross-country demands you know the weather patterns of the route to ensure adequate skiing conditions. Your trail should be located in an area that will receive at least 15 cm of snow - preferably 60 cm or more - for several months during winter. You'll also need to know a great deal about the terrain. North-facing slopes, for instance, will retain snow longer than south-facing slopes. And, you'll need to know where your route should be located to avoid the prevailing winds.

These factors will help you determine the trail's layout. Many types are suitable: loops, spoked loops, satellite loops, maze and linear layouts. Find out all you

can about the physical features of your route in detail before deciding.

When you inspect the area, plan for a trail that will give a ratio of 1/3 over the flat ground, 1/3 downhill and 1/3 uphill going in any one direction. Try to avoid very steep slopes, unless only very expert skiers will be using that part of the trail. Similarly, stay away from sharp dips and turns, steep angles on cross slopes and dense stands of conifers. The snow under these trees may not be deep enough for good skiing. Do try to include a variety of interesting scenery, including panoramic views of the countryside.

How long should your trail be? Total length for a trail system will depend on how many alternative loops can be provided on the land that is available and the type of terrain that is to be crossed. For novice skiers and for partial day use, provide short base loops between 3 and 5 km. For full day use, a minimum distance of 15 to 20 km is recommended. The maximum distance depends upon the class of skier. For intermediate skiers 22 km will probably be adequate (four hours skiing at 5.5 km/h); for expert skiers 36 km (four hours at 9.0 km/h).

The grade of the slope will also depend on levels of expertise. For novices, 10%, intermediates, up to 25% and experts, up to 40%. Steep runs should be kept short so that skiers don't lose control.

Right-of-way clearances should be wide enough for three skiers on main trails - about 4 m - or as narrow as 1.5 m on side trails. If you plan to use track setters on all trails, though, you'll need a minimum of 2.5 m.

A good rule of thumb for height clearances is to allow 2.5 m plus the depth of snow you expect on the trail.

Among the structures you could include are bridges, especially over streams that do not freeze completely. These should be wide enough for track setters; over shallow streams a layer of brush is often sufficient as a base for snow cover. On longer routes, you may also want to consider shelters and toilet facilities.

An important feature of your ski trail will be signage - not only for convenience but to ensure the safety of skiers. These should indicate:

1. At Trail Head:
    a) For ONE trail - name, length and degree of difficulty.
    b) For MULTI-TRAILS - maps of all trails, lengths, locations of natural features and facilities.
2. At Junctions: names of intersecting trails and directions to points of interest.
3. Directions.
4. Warning of hazards.
5. Location of shelters, toilets and water sources.

Setting track should be part of your overall program. To maintain ideal trail conditions, you'll need to plan for the lease or purchase of a good track-setting and trail-grooming machine in your budget.

Guidelines:

Layout:
- Stacked or satellite loop, spoked wheel or maze

Length (for full day use):
- Novice - 5 km
- Intermediate - 22 km
- Expert - 36 km or longer

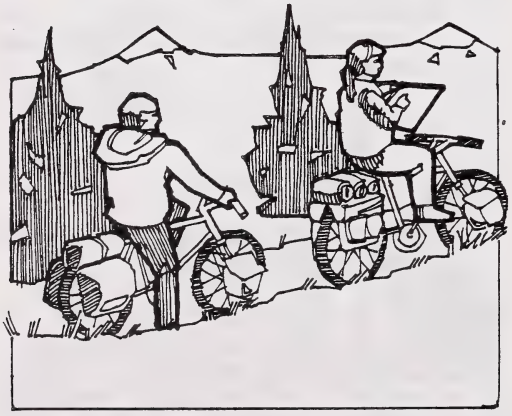
Grades:
- Novice - to a maximum of 10 percent
- Intermediate - to 25 percent
- Expert - to 40 percent

Right-of-Way Clearance:
- 1.5-4 m width
- 2.5 m plus height of snow

Structures:
- Cabins, bridges, rest stops, shelters

Facilities:
- Signs, toilets

Bicycle Trails



Bicycles are more than just another form of transportation. They are also an excellent way for people to get into shape while experiencing the outdoors at their own pace.

The popularity of cycling has grown tremendously in recent years and, as the trends show, will continue for years to come. An investment in a bicycle trail, though higher than other types of trails, is one that will be enjoyed for many years to come.

Basically, there are two types of bikeway systems - urban and touring. Most large urban centres already have a bikeway system linking roadways with trails specifically designed for cycling. This manual will focus on the planning, design and construction of touring trails.

As with any trail, the type of bicycle trail you build will depend on who is most likely to use it. Consider whether it will be for cyclists only or for mixed traffic. What is their level of skill? Do they intend to use the trail for day trips, weekend outings or extended hours? Other factors to be aware of are the safety and comfort of your trail users. All these considerations will affect the shape of the trail and the facilities you include.

How far you extend your trail depends on the level of cycling expertise. The beginner usually travels somewhere between 5 and 10 km in a day. More experienced riders can travel approximately 60-70 km.

To accommodate different skill levels, a layout with several loops is an excellent choice. With this type of system, a greater variety of terrain can be covered. Some

loops can be shorter for less experienced riders, while others can be longer.

Linear trails, incorporated into existing roadways, are an alternative layout to consider if the purpose of your trail is primarily to access a major point of interest or activity.

Campsites for either a loop or linear system should be spaced fairly close together: 60-70 km apart (the distance travelled by an experienced cyclist in one day).

To ensure the safety and comfort of cyclists, there are two main factors to keep in mind. The steepness of the grade and the angle of the trail curve.

Generally, keep grades to 3%. At most, a grade of 6% is advisable, but only for short distances. A 10% grade over 30 m long will be too steep for all but the most physically fit cyclists.

Try to avoid too many hills as they will force up the cost of construction and discourage people from using the trail. However, long stretches of straight, flat terrain can quickly become monotonous. Design your trail so that it follows a curved path along gently rolling ground.

Adding a few sharp digs and curves will contribute to the challenge and excitement of your trail.

For safety, design curves with a turning radius of at least 4.6 m at speeds of 16 km/h; 10.7 m at 24 km/h; and 21.3 m at 32 km/h. Every curve should also have long sight lines and warning signs to allow riders to stop quickly in emergencies.

The surface of the trail is another important factor for the safety and comfort of riders. Surfaces should be smooth and even. Over most of your trail, the tread should be paved with asphalt (plain or with a rolled-in stone chip finish). In some places, well-compacted crushed gravel which is free of potholes is acceptable and can even provide a break in the monotony of the surface. Loose gravel and stone, however, are not adequate for the needs of cyclists. To ensure proper drainage, construct tread surfaces with a cross-slope at a rate of 2%.

The width of the trail tread will depend on levels of traffic. The minimum width for a one-way trail should be 1.2 m. For two-way traffic, the width should be 2.5 m. If pedestrians will be sharing the trail, allow at least 3 m.

Make the trail route as free from obstructions as possible. Trees and signs should be kept back at least 30 cm from either side. Above the trail, keep a clear height of 2.5 m or more.

A final consideration is signage. All signs should use readily identifiable symbols rather than words and be placed prominently at access points, intersections and all hazardous sections of the trail, such as sharp corners and steep hills. Post recommended speeds where a hill is particularly long and steep.

Guidelines:

Layout:
- Linear or loop with side paths

Length (for full day use):
- 60-70 km (average day trip) or longer

Grades:
- 0-3 percent
- Maximum sustained grade: 6 percent
- Maximum short pitch: 30 percent

Width (bicycle lane only):
- 1.2 m (one-way traffic)
- 2.5 m (two way)

Right-of-Way Clearance:
- 30 cm on either side of the trail
- to a height of 2.5 m

Surfacing:
- Asphalt, crushed stone with stone dust finish

Structures:
- Bridges, rest stops, shelters

Facilities:
- Signs, parking lots, bicycle racks and stands, barriers

Equestrian Trails

Next to walking, horseback riding is one of the oldest and most popular forms of transportation. However, some of the problems associated with equestrian trails are just as age-old.

If you are considering an equestrian trail, you'll need to minimize potential conflicts with other trail users and the impact of horses on the environment. Hikers often resent running into large parties on horseback as they tend to crowd the trail route. You may also encounter problems with horse manure and trampling, which can have a devastating effect on the trail site. Some conflicts can be resolved simply by posting signs and reminding people of the rights of all trail users. Others may not be so easily dealt with. If you cannot avoid conflicts, design separate routes and campsites for hikers and equestrians.

In most cases, the loop form of layout, with additional loops or spurs, is the most suitable. For longer overnight treks, a linear trail is also appropriate. The length of the trail could be anywhere from 5-10 km or even greater. In some areas, you might be able to incorporate old trails and logging roads. Grades should be no steeper than 15% or 20% if the distance is very short.

As with other types of trails, the width of an equestrian trail will depend on the type of use it receives. In most cases, a width of half to one metre is suitable. Right-of-way clearances should be a total of 2.5 m with overhanging branches cleared to a height of at least 3 m.

The material you use to surface the trail is very important to the comfort and safety of horses and for the effect they have on the environment. Asphalt and concrete will obviously be impratical for the injury they cause horses' hooves. A better surface is wood shreds, which resists scattering

and keeps soil in place, or crushed stone, which is ideal for high traffic trails.

You'll also want to take into account the specialized requirements of riders. They will need extra parking or horse trailers, corrals for the care and feeding of their animals and sturdily constructed bridges with smooth deck surfaces.

Once the trail is constructed, you'll need to provide adequate signage throughout the trail system. An accompanying trail map or guidebook is also helpful. You'll also require a careful maintenance program to remove waste from parking lots, corrals and campsites. Where traffic is highest, be sure to keep a close watch for any damage to the environment. Trails on side slopes, for instance, may require extra reinforcing along the outer edge of the trail to prevent erosion.

Guidelines:

Layout:
- Linear or loop with side paths

Length:
- 5-10 km (average day trip) or longer

Grades:
- 0-10 percent
- Maximum sustained grade: 15 percent
- Maximum short pitch: 20 percent

Width:
- 45 cm - 1 m

Right-of-Way Clearance:
- 2.5 m on either side of the trail
- To a height of 3 m

Surfacing:
- Crushed stone (limestone, sandstone, some shales), shredded bark, soil mixed with gravel, crushed stone or grus (decomposed granite)

Structures:
- Bridges, corduroy, rest stops, shelters, corrals, barns

Facilities:
- Signs, barriers, vehicle parking with additional space for horse trailers

TRAIL COSTS

Working out a detailed cost estimate is one of the most important steps to take to ensure the success of your trail. You don't want any surprises later on when your trail is being constructed.

Although the cost of your trail will vary according to the size and type of trail you are building, the following guidelines will give you an idea of how to proceed and where to save money.

Volunteers versus Professionals

The main advantage of using volunteer labour is that your costs will be kept much lower. (Two of the greatest expenses you will have are labour and materials.) An additional benefit is the sense of accomplishment everyone will feel from having participated in the building of your trail.

A drawback with volunteers, however, is that you cannot always rely on this type of labour. They have their own schedules, which you will have to accommodate. It may be a wise move to form several crews that are able to work at different times.

The major advantage of contracting out is that the quality of work generally will be higher and the speed of construction will be faster.

Design

When going into the design phase of your trail, it is essential that you make use of professionals or those who have professional experience. More than any other factor, the design will determine the shape and character of your trail.

As you would when hiring any professional services, be sure to get competitive quotes in writing from three reputable landscape architectural firms. Call several companies to obtain quotes that are in line with your financial resources and trail requirements. Expect to pay anywhere from $40 to $65 an hour.

Construction

The cost of constructing your trail will depend mostly on the type of labour you use, whether volunteer or professional.

If you hire a construction company, once again be sure to get at least three quotes in writing, outlining all the services you expect to receive. Go over the costs and terms carefully before signing.

If you use volunteers, use them where they will be most effective, such as for clearing brush. When surveying and excavating, you're better off to hire professionals.

You can also use volunteers profitably on such tasks as building, assembling and finishing pre-packaged structures. On the other hand, you could have the manufacturer install any structures you buy. If you make the sale of 100 picnic tables contingent on free installation, you'll have a powerful bargaining point in your favour.

For the same reason, be sure to order all materials at the same time from one supplier. Volume buying will give you a much greater discount than if you buy one item at a time.

Maintenance

The primary costs of maintaining your trail system will be labour and equipment. Again, you can save money if you use volunteers or hire students during the summer months. For tasks that need to be done only once in a while, such as ski trail grooming, hire a contractor on a project basis.

Most of your equipment costs will be during the initial stages. Tools and equipment such as lawn mowers represent major expenditures but, once purchased, will give you years of service. Minor expenses such as paint, herbicides and signs that need to be replaced will be ongoing.

Cost Samples

(All figures given are approximate)

LANDSCAPING	$ 2,333.00/hectare
NATURAL SURFACE TRAIL (1 m wide)	2,000.00/hectare
PEDESTRIAN TRAIL Gravel (2.5 m wide) Gravel (1.5 m wide)	 20,000.00/kilometre 12,000.00/kilometre
BICYCLE TRAIL Asphalt (2.3 m wide, 10 cm deep)	37,500.00/kilometre
PICNIC SITE 1 Table, 1 Firepit, unsurfaced	1,000.00/each
TURNPIKE Dirt surface with railroad tie edging	500.00/30 metres
BRIDGE Laminated treated lumber (7 m span, 1.5 m wide)	20,000.00
CULVERT Corrugated metal pipe (35 cm diameter)	60.00/metre
TIMBER RETAINING WALL (.7 m above grade)	60.00/metre
SIGNS Timber marker Wood Panel (50 x 70 cm)	 75.00/each 300.00/each

Sample Trail Cost Estimate Form

The cost of your trail will be a reflection of the kind of trail you build, its design, the type of labour you use, structures and finishing touches. If, after filling in this form, you find that the costs exceed your budget, remember that you can proceed in phases rather than all at once or you can build just one section of your trail.

PHASE I - PLANNING

Research Materials (Documents, maps, aerial photos, etc.)	$_____
Consultant Fees	$_____
Publicity Materials (Brochures, newsletters, advertising)	$_____
Incorporation Fee	$_____
Testing Fees (Soils, groundwater, vegetation, etc.)	$_____
SUB-TOTAL	$_____

PHASE II - DESIGN

Survey Fees	$_____
Landscape Architect's Fees	$_____
SUB-TOTAL	$_____

PHASE III - CONSTRUCTION

A. SITE PREPARATION

Tools/Equipment (Axes, shears, etc.)	$_____
Staking	$_____
Clearing	$_____
Stripping and Stockpiling Topsoil	$_____
Excavating, Grading	$_____

B. DRAINAGE STRUCTURES

Waterbars	$_____
French Drains	$_____
Grade Dips	$_____
Culverts	$_____

C. EROSION CONTROL STRUCTURES

Retaining Walls	$_____
Switchbacks	$_____
Steps	$_____

D. WATER CROSSINGS

Bridges	$_____
Turnpikes	$_____
Puncheons	$_____
Corduroy	$_____

E. TRAIL SURFACES

Subgrade Preparation	$_____
Wood Chips	$_____
Gravel, Limestone, Shale	$_____
Concrete	$_____
Soil Cement	$_____
Asphalt	$_____
Parking Lots	$_____

F. REVEGETATION

Topsoil	$_____
Seeds/Sod	$_____
Fertilizer	$_____

G. FINISHING TOUCHES

Signage	$_____
Control Structures (Bollards, gates, stiles, dodgeways)	$_____
Benches	$_____
Lookout Platforms	$_____
Picnic Tables	$_____
Fireplaces	$_____
Washrooms	$_____
Lighting	$_____
Litter Bins	$_____
Wheelchair Ramps	$_____
Bike Racks	$_____
Exercise Equipment	$_____
Corrals, Barns, Fencing	$_____
Wells, Running Water	$_____
SUB-TOTAL	$_____

PHASE IV - MAINTENANCE

Labour	$_____
Tools	$_____
Equipment	$_____
Supplies (Herbicides, paint, stain, varnish, etc.)	$_____
SUB-TOTAL	$_____

TRAIL PLANNING CHECKLIST

1. Goals and Objectives

   Does your plan answer the following:

   * What is the project? Yes ( ) No ( )
   * Who is it for? Yes ( ) No ( )
   * Why are we building it? Yes ( ) No ( )
   * Will it duplicate another nearby trail? Yes ( ) No ( )

2. Does your plan answer the concern for:

   * People? Yes ( ) No ( )
   * Nature? Yes ( ) No ( )

3. The Planning Group

   Do you have representatives from all interested user groups, legal help, parks consultants, etc.? Yes ( ) No ( )

   Have you divided responsibilities for obtaining more information, investigating sites, finding money? Yes ( ) No ( )

4. Information Collection

   Have you made every effort to involve the entire community in the project through:

   * Questionnaires? Yes ( ) No ( )
   * Presentations? Yes ( ) No ( )
   * Interviews? Yes ( ) No ( )
   * Workshops? Yes ( ) No ( )
   * Public meetings/discussions? Yes ( ) No ( )

   Have all potential sources of funding and materials been identified and contacted? Yes ( ) No ( )

5. The Site Program

   Will your trail be:

   * Aesthetically pleasing? Yes ( ) No ( )
   * Environmentally responsible? Yes ( ) No ( )
   * Functional? Yes ( ) No ( )
   * Affordable? Yes ( ) No ( )
   * Legally viable? Yes ( ) No ( )

Does your plan reflect the needs of the community? Yes ( ) No ( )

Has construction been phased over a number of years to fit your resources and abilities? Yes ( ) No ( )

6. The Site

Have all potential problems and conflicts been identified and resolved? Yes ( ) No ( )

Are current user patterns of the site and adjacent facilities understood? Yes ( ) No ( )

7. Developing a Plan

Have you contacted a landscape architect or designer? Yes ( ) No ( )

Has a formal plan been developed? Yes ( ) No ( )

Has a drawing been completed? Yes ( ) No ( )

8. Implementing the Plan

Have all approvals been granted by all concerned authorities? Yes ( ) No ( )

Does the community have the skills, resources and enthusiasm to provide volunteer help? Yes ( ) No ( )

Should a contractor be hired? Yes ( ) No ( )

Is the work of the volunteers clearly identified and organized? Yes ( ) No ( )

9. Reviewing the Plan

Have the plan and design been reviewed? Yes ( ) No ( )

Can you identify improvements, additions? Yes ( ) No ( )

Do you have a maintenance program? Yes ( ) No ( )

Who will carry it out?

Will the trail be continually monitored to measure its effectiveness? Yes ( ) No ( )

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For more information, the following sources will provide you with details on the planning, design, construction and maintenance of recreation trail systems.

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